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Electrical World

McGraw-Hill Company, Inc. New York, September 3, 1921 Twenty-five Cents a Copy

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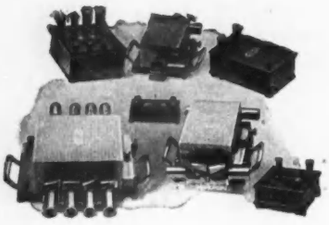

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Electrical World

New York, Saturday, September 3, 1921

Circulation—What It Means to Every Reader

THE reader of a magazine is apt to think that circulation is a matter that concerns the advertiser only.

"My interest is in the contents of the publication," he says. But with a business paper of broad scope like the ELECTRICAL WORLD—the news, the trade and the technical journal of a great and growing industry — the reader *is* concerned with circulation. For here we find proof of its reading value.

The electrical industry, roughly, is made up of seven groups, as follows:

1. Manufacturers and distributers.
2. Central-station companies and municipal electric systems.
3. Industrial and private power plants.
4. Jobbers, contractors and dealers.
5. Electric railways.
6. Telephone and telegraph companies.
7. The new field of radio communication.

The production or income of these major groups shows their relative position in the industry. The per annum figures are:

Manufacturers and distributers	$1,250,000,000
Central-station companies and municipal systems	900,000,000
Industrial and private plants	200,000,000
Electric railways	800,000,000
Telephone companies	550,000,000
Telegraph and radio	250,000,000
Miscellaneous	250,000,000
Total production	$4,200,000,000

That, in round figures, is the bulk and balance of the electrical industry. Now as to the measure of the service rendered by the ELECTRICAL WORLD, as indicated by the kind and number of the men who read it.

There are two classes of men who carry the world's work—business planners and result getters. The business planners investigate, decide and direct; the result getters accept the business planners' judgment and by utilizing labor and materials work out their plans. There are more of these result getters than of the business planners. Both are vital, and in our industry both read the ELECTRICAL WORLD. Here are the figures of our circulation grouped this way:

The Business Planners—	
Executives in charge of company and engineering policy for central-station companies and electric railways	2,644
Executives in charge of company and engineering policy with industrial plants and electrical manufacturers	1,301
Executive and engineering specialists in the allied fields of generation, railway, telephone, telegraph, radio, illumination, chemistry, finance and education	5,149
	9,094
The Result Getters—	
Operating and administering executives with central-station companies and electric railways	3,459
Operating and administering executives with industrial plants, electrical manufacturers, mills and mines	6,416
Sales managers and sales engineers with central-station companies, electrical manufacturers and large contractors, dealers, jobbers and exporters, plus the miscellaneous	3,231
	13,106

From this you know that over 22,000 electrical men subscribe to this magazine you read. And it does mean something to you. For the distribution of this circulation among both business planners and result getters is an eloquent testimony to the recognition which the ELECTRICAL WORLD has won by its broad service. It is an indorsement—proof of its worth to you. If these men, week after week, study the industry, its records and its thinking here, it is a call to you also to read more broadly and to learn more fully as the industry progresses.

William Creighton Peet

An electrical engineer, contractor and advocate of co-operation who has achieved notable success in electrical contracting work, has worked intelligently to improve the National Electrical Code and has devoted his talents, personality and conscientious leadership to the betterment of the contractor-dealer group of the electrical industry.

WORKING for an industry to expand its scope and increase its productiveness is like working in a garden. It requires the constant attention of individuals vitally interested in its success. Among those few in the electrical contracting field who have given themselves without stint to the organization and development of that branch of the electrical industry is William Creighton Peet, president and founder of Peet & Powers, electrical engineers and contractors of New York City.

Born in New Orleans, La., Oct. 20, 1871, Mr. Peet entered the Massachusetts Institute of Technology in 1890. Two years later he went to Germany for a short course at Heidelberg. Forced to remain in that country because of a cholera quarantine, he continued his engineering studies at the Technical School at Darmstadt, completing the electrical engineering course in 1895. Following his graduation he accepted a position as engineer of construction with what was then the Shuckert company. While with that company he had complete charge of the electrical work of the Bavarian Exposition at Nuremberg, Bavaria, in 1896. Returning to the United States in 1897, he entered the laboratory of the American Telephone & Telegraph Company, where he was associated with Col. J. J. Carty and Bancroft Gherardi in experimental and development work. He later became associated with the George A. Williams Company of Jersey City and for that company carried out the installation of two electric lighting plants—one at Hagerstown, Md., and the other at Newport News, Va. After completion of this work Mr. Peet entered the contracting business for himself, and in 1902 he formed a partnership with Joseph A. McAnerney and Walter H. Powers. Later in that year the present company of Peet & Powers, Inc., was formed.

It was at this time that Mr. Peet became closely identified with the development and organization of the electrical contracting business. Always a silent and tireless worker, he has never been given to spectacular methods of accomplishment. In 1902 he became secretary of the Association of Electrical Contractors of New York City and later was made its president, serving also for a number of years on its executive committee. Upon the reorganization and formation of the present National Association of Electrical Contractors and Dealers at St. Louis in 1918, Mr. Peet was elected chairman, in which capacity he served for three years. He was one of the founders of the Conference Club in 1916 and has acted as treasurer since that time. The formation of the Institute of Electrical Contractors, of which Mr. Peet was first treasurer and is now president, was largely a result of his endeavor.

Mr. Peet has also served as chairman of both the code and jobbers committees of the National Association of Electrical Contractors and Dealers and as a strong advocate of co-operative principles had the appointment of the representatives on the Council of Industrial Relations for the Electrical Construction Industry, which was successful in bringing about eighty-five settlements last year.

Throughout his career Mr. Peet's ability as an organizer and co-operator has been widely recognized as attested by his selection to discharge many responsible duties in association work. At the last convention of the National Association of Electrical Contractors and Dealers the past-president's emblem was presented to him in appreciation of his work for that organization.

Electrical World

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Non-Employment in the Electrical Industry

WITH any decline in general business it is inevitable that the electrical industry should also be affected, particularly the manufacturers of electrical apparatus. However, the existing situation is not so gloomy as many think. Non-employment there is, and President Harding has called a conference this month to discuss the distribution of labor and the rehabilitation of industry. On the other hand, Secretary Hoover declares that the business situation is improving. While he is not blind to the prevalent lack of employment, he says: "It is inconceivable that America, with its surpluses of food and clothing, with housing—although crowded—and with an abundance of fuel, should allow any suffering of those among our people who desire to work." Of course, there can be no permanent remedy without the rehabilitation of industry.

If Congress would only commit itself to a constructive policy, confidence would come quickly, factories would be busy on full time and the employment problem would disappear. Not a little of the non-employment in the electrical industry is attributable to the lack of appropriations to carry out commitments already made by the army, navy and other departments of the government. If funds were voted to complete this work, entered into in good faith by the manufacturers of electrical apparatus with governmental departments, it would be a boon to the electrical industry. Unlike the farmers, cotton growers and exporters, the electrical manufacturers seek no subsidy or advances from the government; they ask only that it live up to its obligations.

A Brilliant Investigator Lost to Science

IN THE death of Dr. Peter Cooper Hewitt applied science suffers a loss that it cannot yet fully realize. Born to wealth, position and ease, he chose to spend his life and talents in productive labor rather than in purposeless luxury. Dr. Hewitt is best known to the public by the incandescent vapor lamp that bears his name. This exceedingly useful illuminant was the result of many years of patient investigation on his part, and it has found an important place in industrial lighting. He was perhaps almost equally well known for his fundamental work on the mercury rectifier—work which was followed up by other investigators until this extraordinary apparatus has become a most useful adjunct of the dynamo not only in street lighting but in some of the serious work of power distribution as well. It has not yet been brought to its full industrial value or turned to the larger uses for which in the course of time it will probably be available. Besides these notable inventions, Dr. Hewitt was constantly engaged in experimental work in many branches of physics, bringing to his investigations the resources of an exceptionally keen, alert and well-trained mind and a persistence which marks the true spirit of research. He was possessed of a most attractive and interesting personality, worthy the son and grandson of his brilliant progenitors. His inventive skill touched many things, but he will be best known in the history of science as the first successful worker in the field of what one may call electronic engineering, breaking away from the conventional lines of electrical conduction and opening, particularly in the rectifier, a new line of practical advance which leads to a goal that no man dares predict.

A host of workers have followed in the path which Peter Cooper Hewitt blazed out and which is constantly diverging into great and unknown fields. The outlook thus bestowed far transcends any material achievement of the inventor. A generation hence the world will have begun to reap some of the bigger benefits conferred by the discoveries of one who never shunned the skirmish line of science for the security of a standardized dugout.

Government Ownership and Organized Labor

NOTWITHSTANDING the country's costly experience in operating the railroads during the war and the wreck of all system and discipline which attended it, the executive council of the American Federation of Labor, in session this week, discussed a movement to bring about public ownership of steam railroads. Naturally, organized labor would look with favor on any scheme which would place it in control of public utilities and which, moreover, would mean less work and higher wages. But memory is not short-lived. This generation knows only too well what government ownership portends, and it is not likely to accept the burden a second time. However, those in control of the labor unions are shrewd and ingenious and can be counted on to make the most of their opportunities. Therefore all utilities must be prepared to combat this propaganda and to look well to their own service and its cost. Good service at reasonable cost is the best and most effective antidote for government ownership clamor, and against it no union of labor forces can prevail.

Broader Functions of the Commercial Department

A MANUFACTURING business is usually organized into three departments—production, sales, financial. The sales department is responsible for going out into the market and getting business. The production department must procure the necessary raw material and produce the goods to fill the orders that the sales

department has turned in. The financial department must provide the money to finance both manufacture and sales and take care of the accounting. At the head of each department is an executive, and the managers of sales and production must have equal rank and work together like a team of good gray horses, or the business will be thrown out of balance.

The chairman of the N. E. L. A. Commercial Section at the Chicago convention pointed out that this balance of organization is as necessary for the central-station company as for any other manufacturing business and recommended urgently that all the commercial activities of light and power companies should be grouped together under one head responsible not alone for sales but for all the relationships of the company with the public. The idea is carried still further in the article by T. I. Jones in this issue. It has sound reason and practical business sense to advocate it, and the best proof of its practicability lies in the fact that there are large companies already organized this way. It is one more growing indication that the importance of the business side of the central-station organization must be recognized.

The Golden Rule Is the Safest Guide

THE simplest things are often the hardest to comprehend. This was illustrated when Alex Dow, speaking before the Michigan Electric Light Association, told the history of the dealings of the Detroit Edison Company with its public. His hearers expected to learn of some new and unusual methods. Mr. Dow told a story of three simple essentials and their application that every business man ought to know by heart, but of which, unfortunately, too many apparently have never heard. Avoidance of annoying rules and still more annoying efforts at enforcement, extreme care in making promises either directly or by implication, but promises once made to be kept at all costs, and, finally, service that gives what the customer is entitled to—these are the three foundation stones on which the success of the company has been built. "Can't do it because the company's rules forbid" is a thoughtless statement that will irritate the average man when a little careful explanation without any reference to rules would let him understand why his request cannot be met—or it may reveal the foolishness of the rule and prevent any attempt to apply it. Under the insistence of a customer it is hard for the average individual to say that no promise can be given, and too often the customer is left to believe that he has been promised something when the fact is that some one has evaded the issue by making statements that can be twisted to mean what the customer wants them to mean. Last but not least, the feeling that he has paid for something that he is not getting is one of the most galling ideas that the average human being can entertain, and the feeling rankles as few other feelings can.

These three things when thoroughly understood comprehend a very wide range of business problems. When employees are thoroughly impressed with the importance of these elementary principles and with the further fact that the truth told squarely and tactfully is always the easiest and safest way out in dealing with the public, there will be less trouble. The average man may not find the truth always palatable, but it is far more agreeable to him than evasion and a feeling that he is not getting what he believes he has paid for. When sifted to the final analysis, Mr. Dow's statement of how the task has been accomplished is only a statement of how the golden rule has been applied. "As ye would that others should do unto you, do ye even so unto them" is not an arbitrary religious command. It is the statement of a fundamental law on which all lasting human success is built.

Reduction of Rates to Pre-War Basis Must Not Be Expected

THAT the cost of turning out energy for public service has greatly increased since pre-war days is a fact unpleasantly familiar to managers of central-station companies. That they have faced the situation without making it an excuse for profiteering is a fact that ought to be familiar to the public they serve. Few persons, however, realize the extent to which rising prices have affected costs of production as compared with the small increases in rates. The study we print this week by P. M. Lincoln of the actual financial aspect of the situation is therefore just now of peculiar interest. The story of the increase in expense of production is a very striking one. The cost to the consumer has risen but a small fraction of the ratio, and a large part of the difference has been absorbed by searching and vigorous economies of management which do the executives of the companies infinite credit.

In considering the facts that Mr. Lincoln brings to the front the reader must realize that in the main the figures relate to a comparison of pre-war construction with its reproduction in whole or material part today. The considerable factor of costs due to fixed charges would, of course, change enormously as between 1914 and present-day prices. This must not be weighed too heavily, since if the facts were to come before a state commission for action very little account would be taken of the reproduction cost of a plant built and paid for in 1914. However, when increases of capital are necessary for extensions and replacements, allowance should be made for the actual prices current and the necessary rates of interest. The rate of depreciation of equipment is unchanged, but the effect of that rate is read into replacement costs effective at such times as the replacement is really made, and in changes of equipment the recovery value of discarded items is materially greater than it was. Of far more serious consequence with reference to public relations has been the very great increase in operating expenses, including fuel, and the worst of it is that this increase is likely to be permanent. The rate for money may get back to 5 per cent, but the price of coal will not follow it, and wages will not for years, if ever, drop to their pre-war figure. Moreover, every incidental item of operating expense has climbed side by side with the cost of labor and fuel.

The plain moral is that the public cannot in all fairness expect to see the price of electric service decline to a pre-war basis. If the electric light and power companies had followed the example of some of the railway systems by decreasing public service and doubling prices, there would have been a tremendous outcry. But they stood by the public, raised prices no more than was absolutely necessary to keep their heads above water, and did not cut off their less profitable customers. Therefore we believe the public will support them cordially when help is necessary.

Struggling with the Power-Factor Problem

EVER since the beginnings of power transmission the electrical supply company has wrestled with the difficulties imposed by low power factor. The case is, of course, less serious now than when induction motors were a new development. But the demand for cheap, low-speed motors and their use sometimes on very unsuitable loads call for action. It is a fact that any station with a considerable motor load suffers seriously from bad power factor, the more so since it thus loses the benefit of what would otherwise lead to an excellent diversity factor. In this issue L. R. Wilson takes up the treatment of the situation as it exists in a Western generating station of considerable size and sets forth the remedial measures taken. Broadly, the remedy is a charge for the extra capacity demanded, and the chief question for decision is how this charge shall be applied. We have long been disposed to the belief that if there were available a suitable kilowatt-ampere-hour meter the best plan would be to bill strictly on this basis, at a suitable price per unit. At least, this method would be simple and rather effective. In default of a meter to record the apparent energy directly, it can be otherwise deduced and applied to the bill.

The Tucson plan is to assume a basic power factor of 80 per cent and then to increase or decrease the discount as the power factor is above or below normal. The actual figure is 1 per cent added or subtracted for each per cent variation in power factor. The disadvantage is the added complication of the metering, necessitating two instruments, either single-phase or polyphase, as the load is balanced or unbalanced. The plan is certainly reasonably effective and fair enough to all. The whole situation should be the subject of concerted action, for while all the plans in use amount to about the same thing, they do not look quite alike and hence may draw unwarranted criticism.

Phenomena of Arc Rupture

CONTINUOUS satisfactory operation of nearly all classes of electric equipment is assured in the present state of the art as long as circuit conditions are unchanged. Changes of circuit conditions, however, introduce transient surges of energy and variations of voltage often followed by well-known disastrous results. Owing to the infinite variety of combination of circuit constants and current and voltage values, it is as yet impossible to foretell the character and magnitude of transients and so to design equipment to meet all of them.

One of the simplest of transients is that arising in the opening of a continuous-current circuit. Current and voltages are fixed at the instant of opening, and owing to the low value of the latter, electrostatic capacity probably plays no part, inductance being the chief factor. It would appear therefore that here is a promising point for an attempt to adapt design to the character of the transient. An interesting step in this direction is found in the experiments described by O. H. Eschholz in the current issue. The results indicate a definite relation between total voltage (line plus induced) and arc length at rupture, for a given value of current. This result is surprising in the light of the highly complex character of the arc, and it would appear that a wider range of conditions than described, as for example by variations of temperature, air pressure and orientation of line of break, might well introduce influences of their own. The photographic and other studies of the arc under magnetic blow-out add to the value of the paper.

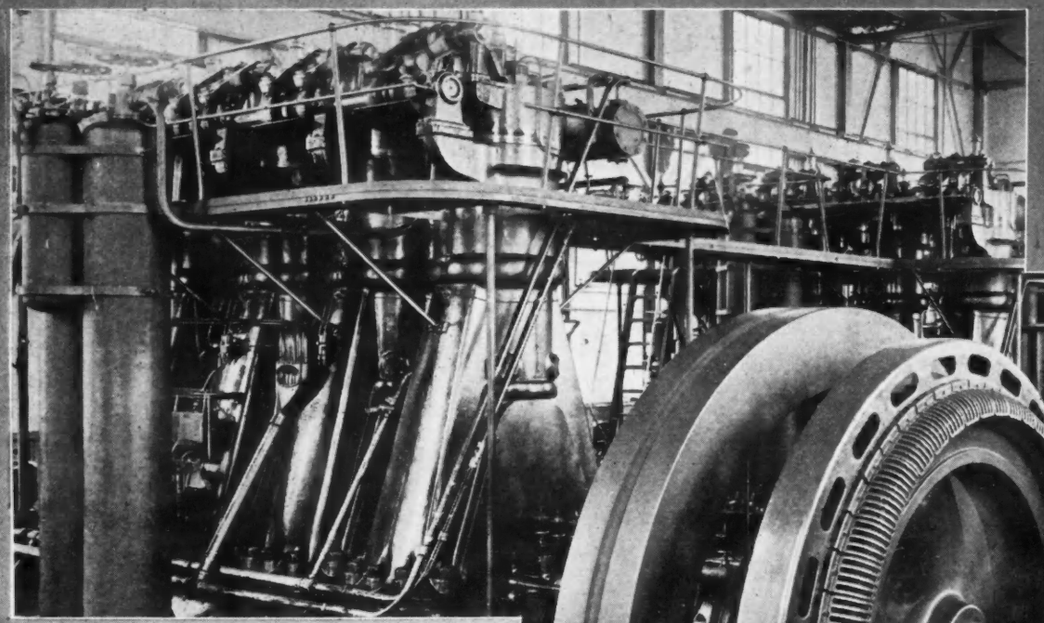
Can the Law of the Sphere Gap Be Simplified?

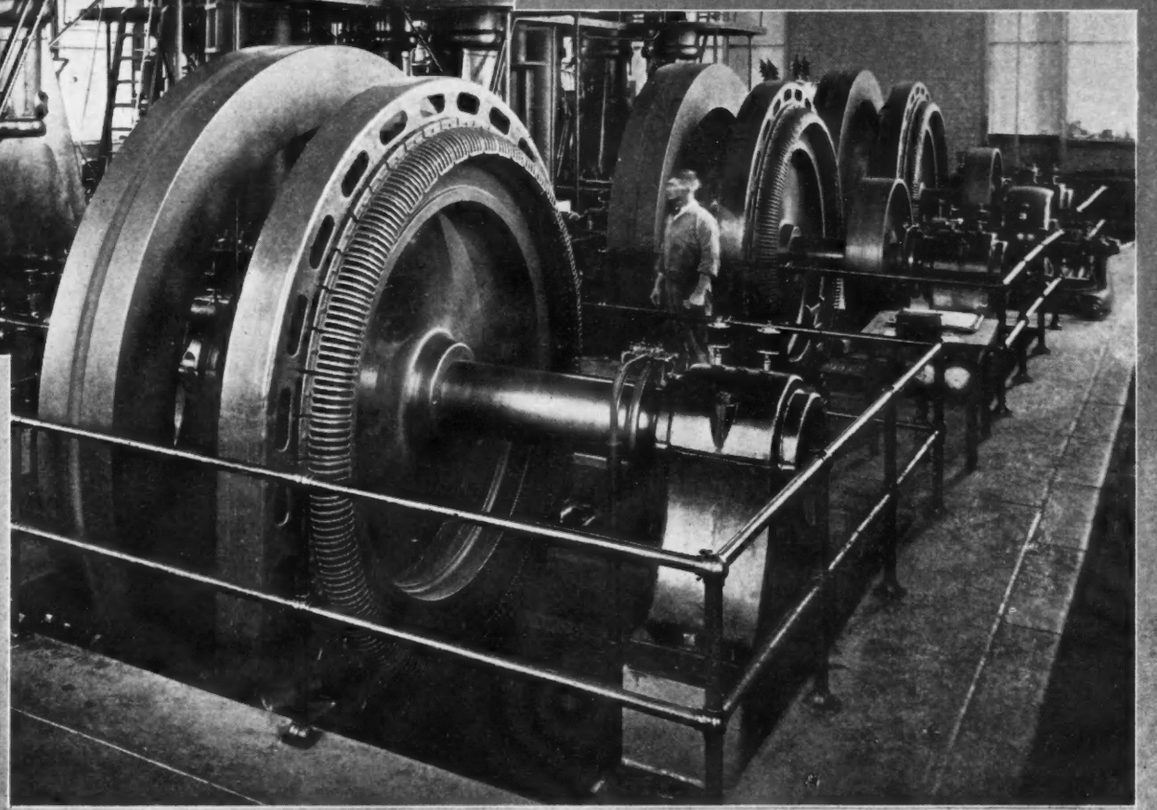
THE adoption by the American Institute of Electrical Engineers of the sparking distance between spheres as a standard of high voltage was probably due in great measure to the simplicity of the apparatus. It is highly desirable in a standard of this character that the quantity involved should be susceptible of definition in terms of simple physical constants such as the dimensions of the apparatus, temperature and pressure. This condition obtains for the sphere gap if both spheres are insulated, but not when one sphere is grounded. In the former case within a wide range of gaps the surface potential gradient at breakdown is a constant for a given size of sphere. In the case where one sphere is grounded, however, this simple type of relation does not hold, and it is not possible to write an expression giving the critical surface gradient for a given size of sphere; the standard must be defined in terms of a drawn curve and with specifications as to size of supports, distance from surrounding objects, etc. This is a serious drawback as it is not always a simple matter to insulate both spheres, and for the grounded case the difficulties of measurement are considerably increased.

Some time ago we called attention to an analysis of the A. I. E. E. figures by Dr. Alexander Russell (*Journal* of the (British) Institution of Electrical Engineers) in which he made the interesting discovery that if, instead of being at grounded potential, the grounded sphere be assumed at a definite fraction of the total potential difference below ground, then the grounded case reduces to the same values of critical gradient as those for the case where both spheres are insulated, and so the use of one formula becomes possible. This leads Dr. Russell to raise a question, not as to the accuracy of the measurements of gap or voltage (as suggested by Mr. Peek in his letter in our issue of June 18), but as to the correctness of the deductions of the values of the potential gradient. In this issue a letter from Dr. Russell is presented commenting on the points raised by Mr. Peek. The interesting suggestion is made that at high absolute potentials there may be some escape of electricity from the sphere, causing an alteration in the normal electrostatic gradient in the air. In the absence of experimental observations of phenomena of this character, this does not appear so strong a support of his contention as his description of an absolute voltmeter in which the attraction between two spheres depends only on the absolute potentials and strictly obeys electrostatic theory. This indicates a normal condition of the medium between the spheres, and so leaves his original comment unanswered and without explanation. In view of the importance of as great simplicity as possible in all standards, it would appear very desirable that experiments on unequal spheres as suggested by Dr. Russell, or other experiments clearing up his question as to the absolute potentials of the spheres in the A. I. E. E. experiments, be carried out. The reduction of all cases of sphere gap to one concise law would remove the most serious objection to this otherwise relatively simple standard.

Diesel Engines

Are Increasing in Popularity for Small Plants and as Standby for Larger Plants





DIESEL engines are not only replacing steam drive in many small generating plants but their choice for standby service to hydro-electric plants and steam plants is becoming more popular. In the sizes in which they are made they have many advantages as prime movers. Their thermal efficiency is high and there is no auxiliary heat generating plant required. They provide a source of energy without ordinary standby losses, fully available within a short time and requiring few attendants for maintenance and operation. In the plant at Paris, Tex., shown in the photograph, less than 12,000 B.t.u. were required per kilowatt-hour generated at three-quarter to full load on the 437-kva. generators.

Generating Costs Have Increased 100 to 175 per Cent Since 1914

Steam Plants Show Average Rise in Production Expense of 137 per Cent and Hydro-Electric Plants Show Average Increase of 167 per Cent —Itemized Production Costs and Increases in Equipment Prices

By P. M. LINCOLN
Consulting Engineer Lincoln Electric Company

IT IS well known that the cost of generating and distributing electrical energy has risen by a very marked degree during the last few years, but it may not be realized that a careful analysis shows increases of 100 per cent to 175 per cent in this cost from the year 1914 to the year 1920. In making such an analysis there are two main items of cost, namely, fixed charges and operating costs.

The fixed charges on a power plant are usually taken to consist of the items of interest, depreciation, taxes and insurance. All of these items are assessed against the first cost of the plant and equipment necessary to give service. The first step in an analysis, therefore, is to ascertain the change in cost of the plant and equipment necessary to give service today as compared with one for the same service before the late war exerted its influence in increasing prices. Steel and copper are the largest single items of raw material that enter into the cost of equipment for power plants. Iron and steel products show some very marked changes during the last five or six years. For instance, the average price of pig iron during 1919 was two and one-fifth times the average during 1914. The highest point touched by pig iron during the period of 1914 to 1919 was nearly four times the average of the year 1914. The composite average of finished steel showed just about the same variations, as might have been expected. Sheet bars, and sheet steels produced from them, show a little greater than average increase. Black sheet steel averaged 2.34 times as high in price in 1919 as it did in 1914, and the highest price touched during the period of 1914 to 1919, inclusive, was nearly four and a quarter times the average 1914 price. Briefly, the ruling price of steel products has risen to approximately double the pre-war price. Steel is the largest single item that enters the cost of a power plant.

Considering copper, the average price in New York during 1914 was 13.61 cents and in 1919 was 19.49 cents, or an increase of 43 per cent. However, in 1917 the price touched 36 cents, or more than two and one-half times the average of 1914. Undoubtedly the government's move in 1917 in fixing prices kept copper from going to a much higher level. This commodity has reacted to the law of supply and demand more readily than some others, and the present price is very nearly the same as the average price during 1914. However, if a power plant had been built during the last two or three years approximately twice as much would have been paid for copper as would have been paid if the same plant had been erected in 1914. This is the significant thing to bear in mind in making an analysis.

But, after all, it is not so much the raw materials that affect the final cost of a power plant as the actual cost of the various items that enter the finished plant. An analysis of the rise in cost of steel and copper is of interest only in showing the reason for the rise in cost of generators, transformers, switches, meters, etc., that go to make up a complete power plant. By the courtesy of one of the large electric manufacturing companies some data have been incorporated in Table I on the actual increases in cost that have taken place in various items of equipment entering a complete plant. The data cover the period from 1910 to 1920, inclusive. It is interesting, first, to note that costs remained very uniform from 1910 to 1914, there being a slight drop averaging perhaps 5 per cent between these two years. Between 1914 and 1915 most items show a slight further drop in price. Beginning in 1915 there has been a rapid and steady increase in the price of all items entering the equipment of a power house. Some naturally show more increase than others, but all show an increase.

In addition to equipment, a complete power plant must include lands and buildings. The actual amount of the increase in these items at present over what would have obtained five years or so ago is difficult to estimate, but there has been a decided increase. The building trades have shown a particularly marked increase owing largely to the much higher labor and material costs that have ruled during the last few years. There is probably no class of labor that has increased more rapidly in cost than that employed in the building trades.

According to an article in the Jan. 29 issue of the *Literary Digest* the so-called "index figure" of all commodities has increased to nearly two and three-quarters the value it had during 1914. This "index figure" is the average price of several hundred standard commodities, each weighted according to the amount of that particular article used.

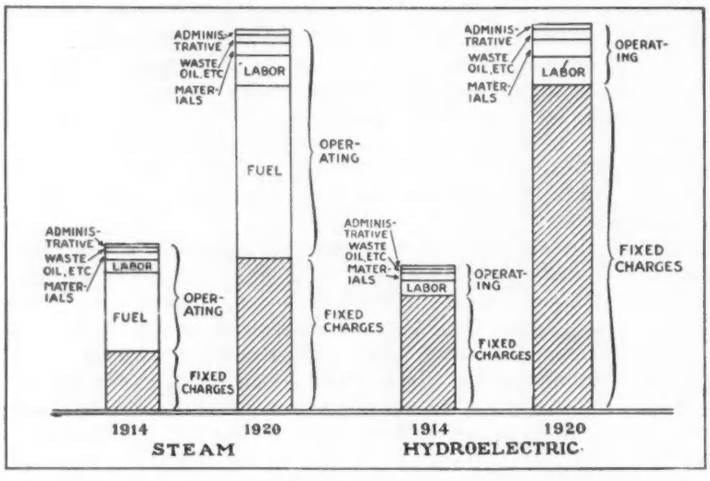
FIXED CHARGES HAVE INCREASED 125 PER CENT

Taking all these data into account, an estimate based on a considerably detailed study, and on manufacturers' quotations, shows that the cost of a plant necessary to produce, distribute and maintain electric service today is not less than 225 per cent of what the same plant would have cost in pre-war days. In making this estimate plants of the character used in any large city for supplying general service are considered.

It may be objected that this has no effect on the cost of producing power, since virtually all the capital expenditures necessary for furnishing electric service to any given center were made before the increases in cost took place, and that therefore the present consumers should not be burdened with this increase in present

capital costs. This is only partly true. Any power plant is constantly growing. Ten per cent per year increase in the production of power is not at all unusual these days, and during the war period the increase in the demand on power plants was often greater than this. A plant big enough for its load in 1914 would not take care of conditions at present. The normal growth during the last five or six years would demand an increase in the normal plant to serve a community. This increase had to be put in at a higher cost. As time goes on the older parts of such a plant are amortized and eventually taken out of service and scrapped. The recently purchased part of the plant must, of course, be considered at present price levels. Whether the older portions should be considered as of the present value of equivalent equipment or as of the value at time of purchase is a question that will not be discussed at this time. It might be observed, however, that rent these days is paid on the basis of the present value and not of the original cost of the property. There is surely as much logic in power costs following the rising costs of equipment as there is in rents following the rising values of buildings and real estate.

In this connection there is another point that should



COSTS OF GENERATING POWER HAVE MORE THAN DOUBLED SINCE 1914

be mentioned, and that is that it is not the first cost but the carrying cost that enters the final power cost. First cost is only one item in establishing fixed charges. Interest, depreciation, taxes and insurance, of course, vary with the first cost, but they may also vary independent of first cost. Thus during the last few years there has been a marked increase in interest rates. Bonds, which five or six years ago could be floated on a basis of 4 to 6 per cent return, must now pay 6 to 9 per cent. Therefore the promoter of a power plant today must not only pay more than twice as much for his equipment as he did six years ago, but when he goes into the money market to borrow his money for the plant he must pay an interest rate approximately 50 per cent higher than he did six years ago. Here again, however, the objection may be made that the plant now furnishing power was purchased at the old prices and, if wisely financed, carries the old interest rate. The writer refuses to discuss the question whether the shrinkage of the purchasing power of the dollar should be taken into consideration in fixing the rates for electric service, but will simply point out that owing to the wearing out and obsolescence of equipment this shrinkage must eventually be recognized.

While there may be some question as to the present value of the item of fixed charges in the cost of power, there are other items where there can be no question of the increase. Operating costs are such an item. The largest item in these costs is the cost of fuel, which has made a very marked and very real advance during the last few years. Coal costs have not only advanced at the mines, but the costs of freights have also increased. A certain plant in New England shows an average of $14 per ton during 1920, as against $5.50 per ton during 1914, or an advance of 154 per cent. Other figures supplied by Babson show that anthracite coal in New York has advanced from $5.75 in 1914 to $10.45 in 1920, or an advance of 81 per cent. Some further figures, obtained from practically every coal-producing state in the Union, show that coal at the mine mouth has increased all the way from 45 per cent as a minimum to 168 per cent as a maximum. The grand average for coal at the mine mouth shows an increase of 129 per cent in cost of 1920 over 1914. The power-producing companies must pay these advances or they do not get any coal. Considering all the data available, it is estimated that the cost of fuel today is 125 per cent above what it was in 1914.

The next item that demands attention is labor. A review of the statistics gathered by the Bureau of Labor Statistics, United States Department of Labor, shows that the rates of wage for power-plant operators during 1920 may safely be taken as 85 per cent in excess of what they were in 1914. For salaried employees the increase is estimated at 40 per cent. The total of this is small compared to the total amounts involved so that an error in this estimate is not important.

Based on the foregoing estimates as to increases in the individual items, an estimate of the increase in cost of producing power ready for distribution in a modern power plant in 1920 as compared with 1914 is given in Table II. For the purposes of the estimate it is assumed that the plant would have a maximum capacity of 100,000 kw., consisting of five units of 20,000 kw. each; that the yearly load factor is 40 per cent and the daily load factor 55 per cent; that the fuel available is bituminous coal of 13,500 B.t.u. per pound, and that this coal in 1914 cost $2.75 per ton and in 1920 $6.18 per ton; that 2.1 lb. of coal was required to produce a kilowatt-hour in both cases; that the plant cost was $60 per kilowatt in 1914 and $135 per kilowatt in 1920; that the fixed charges were at the rate of 12 per cent in 1914 and 15 per cent in 1920; that 350,000,000 kw.-hr. was generated and distributed in each case.

The accompanying diagram shows graphically the relative values given in Table II. The values are more or less typical of all steam plants—at least in so far as a comparison of 1914 with 1920 is concerned. If the location or the size of the steam plant is varied, various items of the comparison might change, but the final result would show an increase in cost of power of from two to two and one-half times as much in 1920 as in 1914.

In considering water powers in making a similar analysis, it must be remembered that fuel costs are entirely absent, but that this absence is largely offset

TABLE I—INCREASED COST OF GENERATING-PLANT EQUIPMENT FROM 1914 TO 1920

Equipment	Per Cent Increase
Turbo-generators	225
Motor-generator sets	147
Rotary convertors	91
Transformers (power)	125
Transformers (distributing)	58
Voltage regulators	48
Switchboard panels	126
Oil circuit breakers	79
Watt-hour meters (single-phase)	38
Watt-hour meters (polyphase)	78
Frequency charger sets	101

by a much higher item of fixed charges. The first cost of the usual water-power plant itself is not only higher as a rule than that of a steam plant, but usually the hydro-electric plant lies at a distance from the market so that there is a considerable item of transmission cost and losses that the steam plant does not in general have to bear. An advantage possessed by the typical water-power plant is that the dams, canals and other works built in connection with it are usually of a more permanent character than a steam power plant, and they therefore carry a somewhat lower rate of depreciation. On the other hand, the metallic structures used in connection with the long-distance transmission system that must be considered as a part of any typical water-power plant should carry a somewhat higher depreciation rate than the steam plant would carry. All in all, the depreciation rate that should be applied to a water-power plant is perhaps slightly lower than that on a steam plant. The items of interest and taxes would presumably be the same for a water-power plant as for a steam plant.

The difference in first cost of a water-power plant and that of a steam-power plant depends on many indeterminate things such as the cost of dams, canals, storage reservoirs and the like, which vary over an exceedingly wide range, and the cost of the transmission system is a function of the amount of power to be transmitted and also of the distance of transmission. There is only one real limit to the cost of a water-power installation, and that is the economic consideration that the market cannot afford to pay more for water power than for the same service rendered by steam. However, the ratio between the cost of a water-power plant in 1914 and in 1920 may safely be taken to be at least as much as that determined for steam plants. For steam plants the figure of 2.25 was taken to represent the ratio of costs in 1920 as compared with 1914. There is no evident reason for departing from the same figure for water-power plants. The cost of buildings and other construction work which constitute the major part of any water-power project has certainly risen by at least as large a ratio as machinery costs.

Table II, giving the estimate of the cost of water power, uses this ratio. The other assumptions used in making the estimates are as follows: That the plant would have a capacity of 100,000 kw. (the same as assumed for the steam plant); that the yearly load factor would be 40 per cent and the daily load factor 55 per cent; that the plant cost was $140 per kilowatt in 1914 and $315 per kilowatt in 1920; that fixed charges on the water-power plant were 11 per cent in 1914 and 14 per cent in 1920; that the plant is 75 miles from its market; that 350,000,000 kw.-hr. was generated and distributed in each year.

TABLE II—INCREASE IN PRODUCTION COSTS FROM YEAR 1914 TO YEAR 1920

Item	Costs in Cents			
	Steam-Power Plant		Hydro-Electric Plant	
	1914	1920	1914	1920
Fixed charges	0.206	0.579	0.440	1.260
Operation:				
Fuel	0.289	0.649	.....	.....
Oil, waste and supplies	0.012	0.024	0.009	0.018
Labor	0.041	0.076	0.033	0.061
Maintenance:				
Materials	0.026	0.053	0.024	0.048
Labor	0.021	0.039	0.028	0.052
Administration	0.008	0.011	0.008	0.011
Totals	0.603	1.431	0.542	1.450

The diagram shows the comparative values. It is somewhat interesting to note that the *increase* in cost of water power has been somewhat larger than that of steam power—a ratio of 2.37 for steam power and 2.67 for water. The reason, of course, is that virtually the entire cost of water power lies in the fixed charges and that the increase in interest rate superposed on the large increase in first cost has caused the resultant cost of water power to increase even faster than has been the case with steam power. Fixed charges in 1920 in the case of water power are 2.85 times those of 1914, and this item amounts to 87 per cent of the total cost.

These estimates include only those costs that are necessary to produce the power and put it on the busbars at the steam generating plant—or the step-down substations of the water-power plant—ready for distribution from that point. To get the power to the ultimate consumer it is necessary to add the costs of distribution, metering, collection of bills, distribution losses, etc. These items vary considerably, depending upon the amounts of power distributed, the layout of the distributing system and many other items, so that it is difficult to take them into consideration in generalizing. They also have risen during the last few years, but possibly not quite so much as the tabulation indicates. The main point demonstrated is that the costs of power production and distribution have risen to two to two and three-quarters times those of six years ago.

In a future issue the question of making rates so that these increased costs may be distributed equitably between customers and power companies will be discussed.

Australia's Brown-Coal Power Scheme

RENEWED public interest in the so-called brown-coal fields of Victoria has been created, according to United States Trade Commissioner A. W. Ferrin, by the controversy, not yet entirely ended, between the brown-coal miners and the government of the state of Victoria, owner and operator of the largest of the brown-coal mines at Morwell, in Gippsland. This brown coal, which is found throughout Gippsland and in other parts of Victoria, is said to be unlimited in extent. Hitherto it has not been extensively mined because of its inferiority to black coal.

Several proposals have been made for the commercial use of the coal transformed into a fuel that will compete with black coal. One of these projects involves the briquetting of the brown coal; another is the production of electricity from the brown coal burned in special furnaces at the mines and the transmission of the electricity to Melbourne and other industrial centers. This second project is now being actively developed through a specially constituted body, the Electricity Commissioners of the State of Victoria.

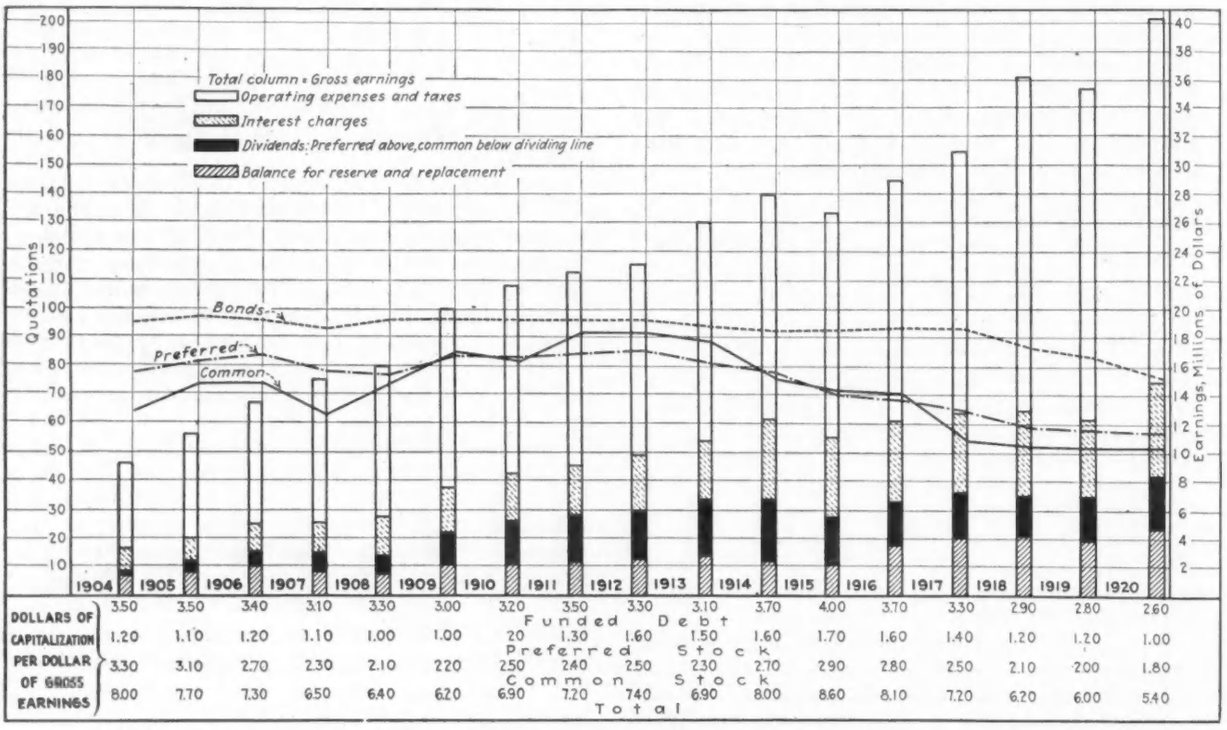
Seventeen Years' Growth of Public Utilities

Stone & Webster Issue Graphic Chart to Make Clear How the Companies Under Their Control Have Prospered in This Period

A CONVINCING illustration of the growth and stability of the public utility industry under able management is afforded in a graphic chart which has been prepared by Stone & Webster, Inc., to show the combined growth of the electric power, lighting and railway companies under the control of this firm in the last seventeen years. The chart indicates year by year the earnings of the companies, the relation of these earnings each year to the outstanding capital, ing of bonds, coupon notes, preferred and common stocks, has increased from approximately $73,000,000 in 1904 to approximately $219,000,000 in 1920. In 1904 for each dollar of gross earnings there was outstanding $8 of capital, divided between $3.50 of debt and $4.50 of capital stock. In 1920 for each dollar of gross earnings there was outstanding $5.40 of capital, divided between $2.60 of debt and $2.80 of capital stock.

CONSERVATIVE POLICY FOLLOWED IN RECENT YEARS

During the past five years, owing to the high cost of raising new capital, a very conservative dividend policy has been followed. This is indicated by the fact that in this period out of the combined balance (after interest charges) of $35,000,000 only $15,000,000 was distributed in dividends and more than $20,000,000 was turned back into the properties. In other words, for


Total column = Gross earnings
Operating expenses and taxes
Interest charges
Dividends: Preferred above, common below dividing line
Balance for reserve and replacement
Quotations
Earnings, Millions of Dollars
Bonds
Preferred
Common
1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920
DOLLARS OF CAPITALIZATION PER DOLLAR OF GROSS EARNINGS
Funded Debt
3.50 3.50 3.40 3.10 3.30 3.00 3.20 3.50 3.30 3.10 3.70 4.00 3.70 3.30 2.90 2.80 2.60
1.20 1.10 1.20 1.10 1.00 1.00 1.20 1.30 1.60 1.50 1.60 1.70 1.60 1.40 1.20 1.20 1.00
Preferred Stock
3.30 3.10 2.70 2.30 2.10 2.20 2.50 2.40 2.50 2.30 2.70 2.90 2.80 2.50 2.10 2.00 1.80
Common Stock
8.00 7.70 7.30 6.50 6.40 6.20 6.90 7.20 7.40 6.90 8.00 8.60 8.10 7.20 6.20 6.00 5.40
Total

CONSOLIDATED CHART OF EARNINGS, CAPITALIZATIONS AND SECURITY QUOTATIONS OF STONE & WEBSTER COMPANIES

The scale for determining the number of dollars measured by these columns appears at the right side of the above consolidated chart.

The average market prices of the various classes of securities are represented by curves which refer to the scale appearing at the left of the chart. The bonds are largely 5 per cent issues and the preferred stocks are practically all 6 per cent issues.

The ratio of capitalization to gross earnings for each year appears at the bottom of the chart. This table is divided to show the funded debt (face value of bonds and coupon notes), the par value of preferred and of common stocks, and the total capitalization to each dollar of gross earnings.

and the resulting effect upon security values as reflected in market quotations. Each year all companies are included which were under Stone & Webster management for the full twelve-month period, any company in the hands of a receiver not being included. The number of companies composing this group has varied from time to time (it is now twenty-eight), but since 1910 the results indicated on the chart have not been materially influenced by such changes.

This group of companies has grown from a combined gross of about $9,000,000 and a net of $3,000,000 in 1904 to a gross of over $40,000,000 and a net of $15,000,000 in 1920. During this period of seventeen years there have been only two years, 1915 and 1919, when gross and net earnings were not larger than in the previous year. The capital outstanding, consist- every dollar paid out in dividends $1.33 of earnings was invested in the properties.

Another comparison brought out by this chart is that in 1920 net earnings increased nearly $2,500,000 from an increase in gross of $5,000,000. During the previous five years, owing to abnormally high operating ratios before increases in rates and fares became generally effective, the average annual growth of net earnings was less than $50,000 from an average increase in gross of nearly $1,500,000. The curves of quotations indicate that the market for bonds has been remarkably stable, generally following the trend of money rates. The quotations for the stocks, on the other hand, have not yet reflected the actual improvement in the industry and the more favorable outlook for the future.

Arc Rupture in Magnetic Blow-Out Switches

Arc Lengths at Which Instability Occurs Are Determined for Practical Conditions—Effect of Electrode Materials, Surfaces, Etc., Investigated—Phenomena of Arc Formation and Rupture Discussed

By O. H. ESCHHOLZ

Material and Process Engineering Department, Westinghouse Electric & Manufacturing Company

DIRECT-CURRENT circuit breakers or switches function by introducing in series with the line an increasing resistance. This resistance possesses transient stability and during the period of stability is of a low order. To assure current rupture, however, instability must be achieved by attaining a critical resistance value, corresponding to a quite definite arc length for given conditions, when the resistance rapidly increases to infinity. The magnetic blow-out field serves to reduce this period of transient stability, thus decreasing arc duration and switch wear from that secured when the rupture length is achieved merely by contact separation. Data are submitted giving these critical lengths, approximately, for various initial values of line current and line voltage at rupture for the usual range of flux densities employed in magnetic blow-out switches.

The utility of present-day circuit-interrupting means depend upon the development of an arc and its subsequent rupture. The sequence of phenomena occurring during arc formation is substantially as follows:

(1) Decrease of contact pressure and area as switch jaws separate, with a consequent increase in the rate at which thermal energy will develop at the contact points.

(2) Increase in current concentration and contact temperature until electron emission is achieved at the negative terminal. (Since this temperature is usually near the melting point of most contact materials electron emission is frequently accompanied by a slight volatilization of the cathode.)

FIG. 1—EXPERIMENTAL AIR-CORE BLOW-OUT COIL AND SWITCH CONSTRUCTED TO FACILITATE OBSERVATION OF ARC PHENOMENA

(3) Slight separation of contacts and current conduction from the cathode to the anode by movement of the electrons.

(4) Collision between gaseous molecules, either of terminal vapor or atmospheric gases, and electrons, resulting in the formation of negative and positive ions.

(5) Continued collision between electrons, ions and neutral molecules with the continued increase in contact separation, the current passing from one terminal to the other as the result of the movement of electrified particles as well as the transference of charges from electron to ion, to ion, to terminal.

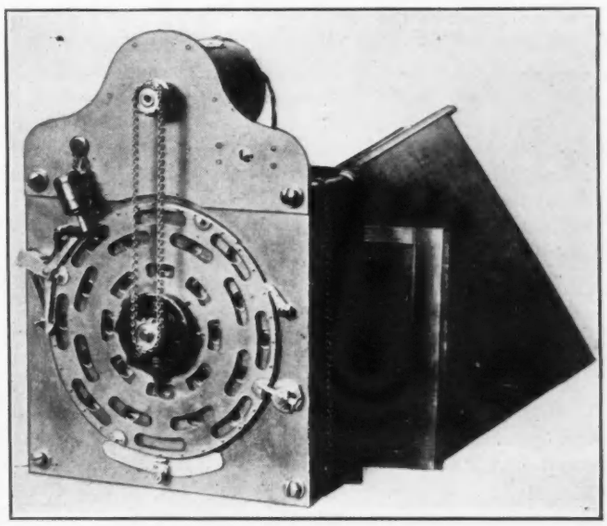


FIG. 2—POLAR, MULTI-EXPOSURE, HIGH-SPEED CAMERA, CONSTRUCTED TO RECORD ARC PHENOMENA

(6) The resulting stream of conducting gaseous material is a flexible conductor whose movement and contour may be controlled by contact separation, gaseous blast, deionizing material or a magnetic field.

The erroneous opinion prevails that arc formation and maintenance is necessarily accompanied by a heavy volatilization of the contact metals. The rate of volatilization is, however, controllable and is dependent upon such factors as thermal conductivity, specific heat, electron emission temperature and melting point of the electrodes as well as upon the rate of movement of the arc terminals on contact faces. In the construction of magnetic blow-out switches it is possible to reduce volatilization on contact and horn material so that the path of the arc terminal is barely perceptible.

The value of an arc as a means for the interruption of direct-current constant-potential circuits lies fundamentally in its ability to serve as a rapidly increasing series resistance. Since the arc is a flexible conductor, it will react to a transverse magnetic field in a manner similar to that of a solid, current-carrying conductor on a motor armature. The speed of movement, and therefore arc-length increase, is a function of the arc current, blow-out field strength, viscosity of inclosing atmosphere and shape of arc terminal path.

Contrary to the usual conception, all arcs in their development pass through a period of transient stability.

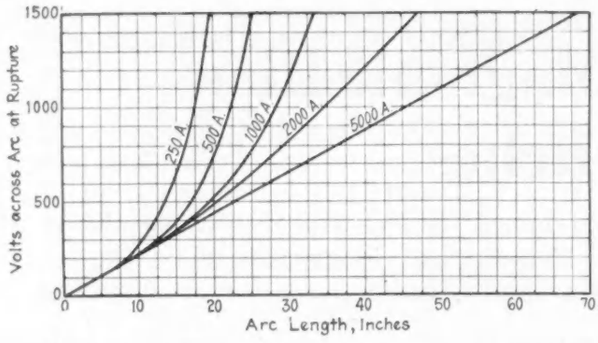


FIG. 3 — ARC VOLTAGES AT RUPTURE PER INCH OF ARC LENGTH AT RUPTURE FOR NON-INDUCTIVE LOADS

It is the object of the arc lamp, arc furnace or arc welding equipment designer to increase the duration of this stability by the selection of suitable electrode materials, arc atmosphere and stabilizing series impedance. It is the purpose of the switch or breaker designer to decrease the period of stability, consistently with such factors as economy of materials, compactness and low voltage surges, by utilizing deionizing means.

When employing the magnetic blow-out switch arc instability and subsequent rupture is achieved by rapidly increasing the arc length until the rate of energy absorption by the inclosing atmosphere exceeds the rate of energy input from the electrical circuit. In Fig. 1 is shown the characteristic functioning of the arc as an increasing resistance. For approximately 80 per cent of its period of duration this arc may be considered to have possessed transient stability. At the end of this period (0.0038 second) the arc attained approximately its maximum length. During the period of instability (0.001 second) the arc resistance rapidly increased to infinity. It is evident that the period of transient stability greatly exceeds that of instability. However, this relation is influenced by the amount of energy stored in the electric circuit, density and distribution of the magnetic field, as well as by the condition of the atmosphere through which the arc is passing.

Since the duration of an arc is chiefly determined by the time required to achieve unstable arc lengths, a knowledge of these arc lengths is an essential requirement in the determination of flux distribution, contact separation and switch contour. As the length of arc at rupture approximates that at the period of instability, it may be used as the criterion of unstable arc lengths.

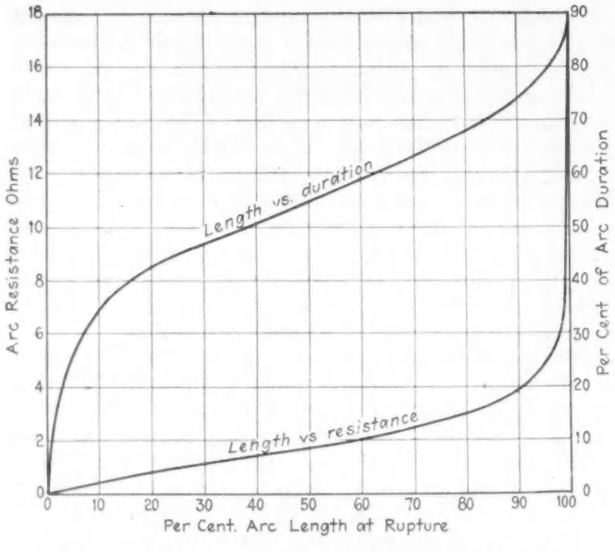


FIG. 4—CHANGE IN ARC RESISTANCE WITH INCREASE IN ARC LENGTH

This illustrates the comparatively long period of transient stability and short period of instability during rupture. Circuit and arc data are given in Table IV.

TABLE I—ARC LENGTH AT RUPTURE; CARBON ELECTRODES
250-Volt Non-Inductive Direct-Current Circuit

Initial Line Current, Amp.	Arc Duration, Sec.	Approx. Maximum Arc Length, In.
60	0.192	5.5
180	0.265	10.5
180	0.245	9.3
310	0.286	12.3
360	0.292	12.8

ELECTRODE MATERIAL AFFECTS ARC LENGTH

In Table I are shown the maximum arc lengths when rupturing the initial indicated line current on a 250-volt direct current non-inductive circuit by permitting a pointed upright carbon cathode to fall from a carbon anode without auxiliary blow-out field. The values of arc length were computed from the arc duration recorded on an oscillograph film and the known distance-time curve of electrode separation.

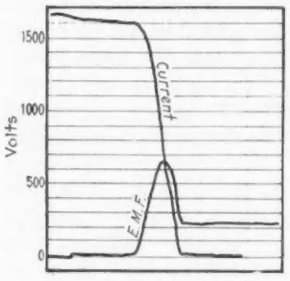


FIG. 5—CURRENT AND VOLTAGE CHANGES DURING ARC RUPTURE. CONDITIONS GIVEN IN FIGS. 3 AND 4 AND TABLE IV

In Table II are given the observations when using a pointed ½-in. (1.27 cm.) diameter lower copper cathode of ½-in. (1.27 cm.) diameter and a 1¾-in. (4.44 cm.) flat stationary copper anode. It will be noted that the maximum lengths obtained with these forms of copper contacts approximate the lengths obtained with carbon electrodes. With both upper and lower copper contacts of 1¾-in. (4.44-cm.) diameter and slightly crowned to assure arc formation in their center, the same maximum arc lengths were obtained provided that the terminals did not move across the contacts. If the terminals are propelled across the contact faces, the added energy required to sustain the arc from an initially cold surface results in a shorter duration and a decreased length at rupture. If the surfaces of crowned copper electrodes, ½-in. (1.27 cm.) in diameter, are highly polished, a marked decrease in arc-length duration is obtained (Table III).

It will be noted from this that a slight erosion of the contact surfaces suffices to increase greatly the arc length at rupture. When breaking an arc between polished copper electrodes one or more globules were invariably formed on the anode surface with a corresponding pitting of the cathode surface. These globules are apparently produced by the condensation of cathode vapor evolved during the initial process of developing the arc. The globule size or number did not appear to

TABLE II—ARC LENGTH AT RUPTURE; COPPER ELECTRODES
250-Volt Non-Inductive Direct-Current Circuit

Initial Line Current, Amp.	Arc Length at Rupture, In.
60	5.6
192	9.3
360	12.0

TABLE III—ARC LENGTHS AT RUPTURE; CONTACT SURFACE POLISHED

250-Volt Non-Inductive Direct-Current Circuit, Copper Contacts of ½-In. Diameter

Test No.	Initial Line Current Amp.	Contact Surface	Arc Length at Rupture Inches	Rupture Length, with Surface Greatly Eroded
1	175	Polished	1.3	6.5
2	390	Polished	1.75	12.0
3	457	Highly polished	1.18	13.5
4	600	Eroded by test No. 3	3.7	15.5
5	562	Eroded by tests Nos. 3 and 4	9.94	15.0

increase with increase in arc duration or rupture length. Similar globular protrusions may be observed on switch and breaker contacts.

On reviewing these data it is apparent that a large variation in arc length at rupture may be obtained, owing solely to the condition of the contact surfaces. The maximum length obtainable within the experimental observations is approximated by the empirical relation $L = 0.0028E\sqrt{I}$.

In order to obtain a record of the arc length at rupture under the deionizing conditions existing in magnetic blow-out switches, high-speed photographs were obtained for each arc as it was blown between two parallel air-core blow-out coils. Fig. 1 shows the appearance of one type of experimental switch as well as the construction of the blow-out coil. In Fig. 2 is shown the high-speed camera employed, described by J. W. Legg on page 510 of the December, 1919, issue of the *Electric Journal*. A complete sequence of arc stream photographs from arc formation to arc rupture is shown in Fig. 6. The duration of each exposure is approximately 0.00015 second, the interval between exposures approximately 0.00028 second. The oscillograph record is shown in Fig. 5 and the relation of arc length to arc resistance and duration in Fig. 4. Some of the data obtained for this arc are given in Table IV.

Stored circuit energy serves to increase the period of arc stability, and if the magnetic field extends beyond a contour necessary only for the rupture of a current flowing in a non-inductive circuit also increases arc length and arc voltage. In the above case, if the circuit had been non-inductive, the arc length at rupture and arc duration would have approximated 11.5 in. (45 cm.) and 0.0035 second respectively.

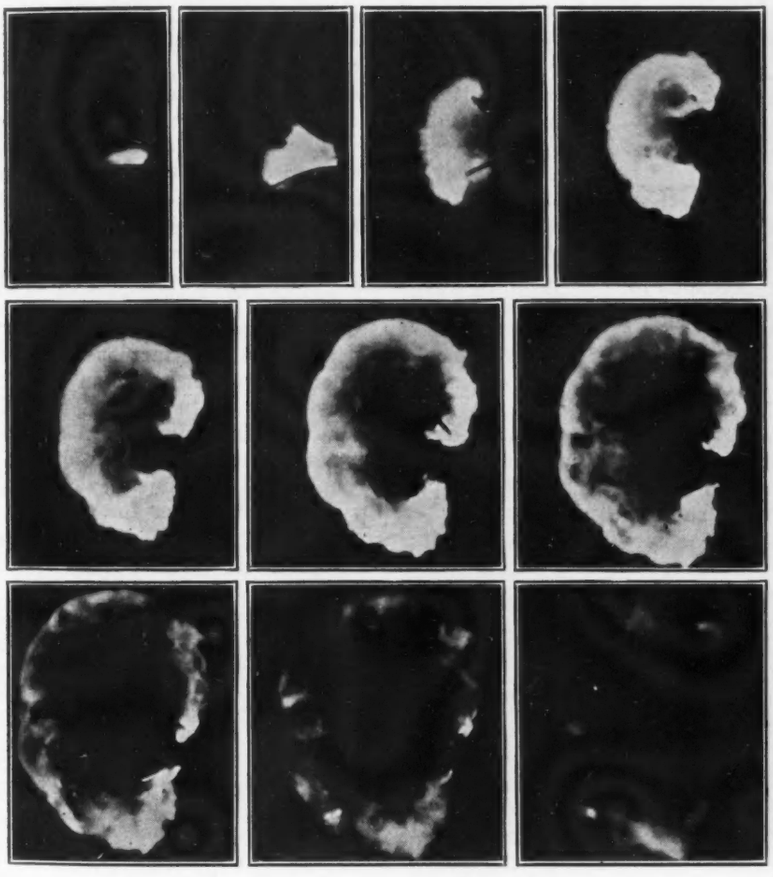


FIG. 6—SEQUENCE OF ARC PHOTOGRAPHS SHOWING CHANGE IN ARC CONTOUR DURING PERIOD OF ARC DEVELOPMENT AND RUPTURE

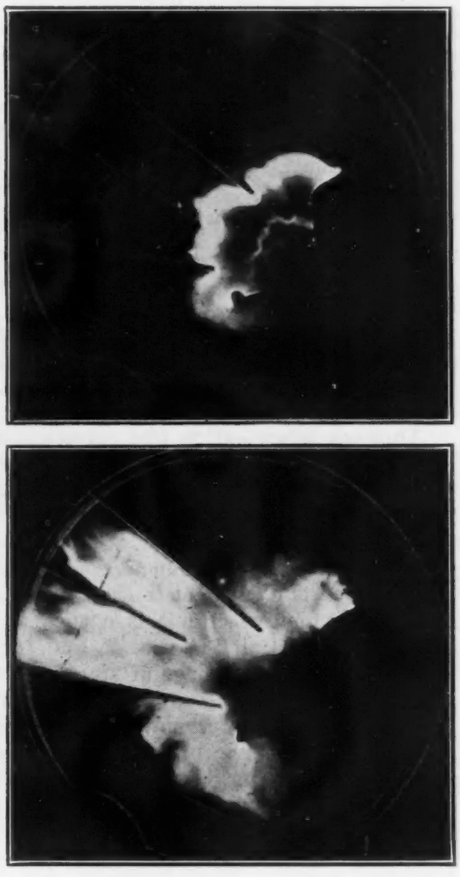


FIG. 7—CONFINEMENT OF A LONG ARC STREAM WITHIN A RELATIVELY SMALL ARC BOX CONTOUR BY THE EMPLOYMENT OF BAFFLES

Switch structures may be designed to give approximately the same arc length at rupture on inductive or non-inductive circuits, although the arc duration will be greater in the former case. If arc duration is the important criterion, the structure may be modified to

TABLE IV—ARC RUPTURE WITH MAGNETIC BLOW-OUT SWITCH

Initial line current, amp.	450
Initial line potential, volts	260
Circuit inductance, millihenries	4
Flux density across path, lines per sq.in. (Blow-out coil in series with line.)	9,000
Arc duration, second	0.0048
Maximum voltage across arc	650
Maximum length at rupture, in.	20
Maximum velocity of arc-stream extension, miles per minute	10
Average velocity of arc-stream extension, miles per minute	2.3

give but slightly greater arc duration on inductive load, with, however, a greatly increased maximum arc length and arc voltage.

Upon obtaining simultaneously arc-contour variation, through the use of the high-speed polar camera, and voltage and current variation, by means of the oscillograph described by J. W. Legg* in the July, 1920, *Journal* of the Institute and the *Electric Journal* for December, 1920, a complete record of arc characteristics for various circuit conditions and air-gap flux densities may be obtained. In Fig. 3 data are shown expressing the relation between initial circuit current and arc volts at rupture per inch of maximum arc length for various total voltages at the instant of rupture. It will be observed that the voltage per unit arc length is asymptotic to approximately 22 volts when employing a magnetic blow-out field to destabilize the arc.

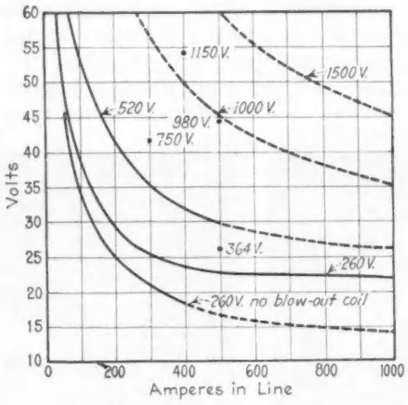


FIG. 7—DATA FROM FIG. 3 REARRANGED TO SHOW APPROXIMATE ARC LENGTH AT RUPTURE FOR DIFFERENT CONDITIONS

Through interpolation and extrapolition of the various data obtained it was possible to construct a family of curves of a practicable degree of accuracy (Fig. 7), showing the relation between length of arc at rupture and line voltage at rupture for various initial line currents. When a non-inductive circuit is interrupted this voltage is equivalent to the initial line voltage, but when an inductive circuit is opened it corresponds to the sum of initial line voltage and the surge voltage produced by the discharge of stored circuit energy.

In view of the long arc lengths required to produce instability when interrupting high initial current or voltage, it is common practice to increase the effectiveness of a given flux distribution by inserting baffles or "splitters" in the path of the arc. These serve to distort the stream as well as to assist in its deionization.

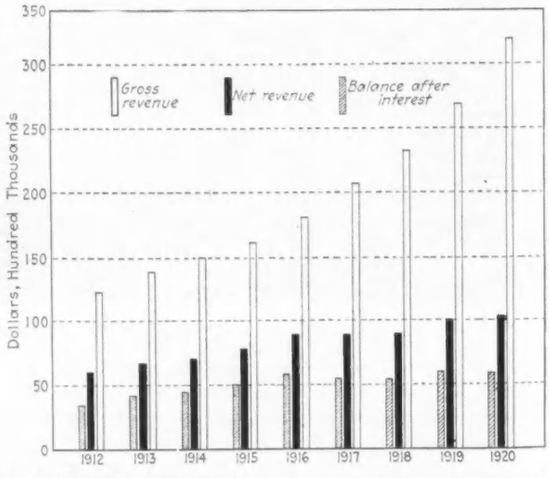
*The author wishes to acknowledge his indebtedness to J. W. Legg for the design and development of the special apparatus employed in this study.

Banker's Study Proves Worth of Electrical Utility Securities

THE accompanying chart, prepared by Paisly Brothers & Company of Philadelphia, bankers, is based on a careful study of the development of the electric light and power industry, of its earnings over a long period of years and of the future prospects for the business. In making this study the bankers utilized reports from twenty-three of the larger electrical utilities of the United States, these being the Niagara Falls Power Company, Montana Power Company, Commonwealth Edison Company, Pacific Gas & Electric Company, Potomac Electric Power Company, Southern California Edison Company, Puget Sound Power & Light Company, Consumers' Power Company, Cleveland Electric Illuminating Company, Pennsylvania Water & Power Company, Detroit Edison Company, Consolidated Gas, Electric Light & Power Company of Baltimore, Scranton Electric Company, Public Service Company of Northern Illinois, New York Edison Company, Buffalo General Electric Company, Southern Power Company, Texas Power & Light Company, Northern States Power Company, Public Service Electric Company of New Jersey, Philadelphia Electric Company, Union Electric Light & Power Company, and Edison Electric Illuminating Company of Boston. The chart shows the gross revenue, net revenue and balance after interest payments of these companies for the nine years 1912 to 1920 inclusive.

The figures in the chart show a gain in gross earnings in every year from 1912 to 1920 inclusive. During this period net earnings have shown an increase over the previous year in every year except 1917, in which year there was a decrease in net of $1,210,000. In this connection it is worth noting that two hydro-electric companies and one company 65 per cent of whose capacity is hydro-electric contributed an aggregate decline in net earnings of approximately $1,750,000. From 1912 to 1916 the balance after interest charges shows an annual increase; 1917 and 1918 show a balance somewhat under that for 1916; 1919 a substantial gain, and 1920 a final result approximately equal to that obtained in 1919.

"It is well known," say the bankers, "that in the past five years there has been a very large increase in those items composing the operating expenses of an electric light and power company—that is, in the cost of coal, in the price of materials for repairs, in labor costs, etc. Light and power companies have, however, fared better than other types of public utility companies for two reasons: first, because it has been easier for such companies to obtain increases in rates to offset increasing

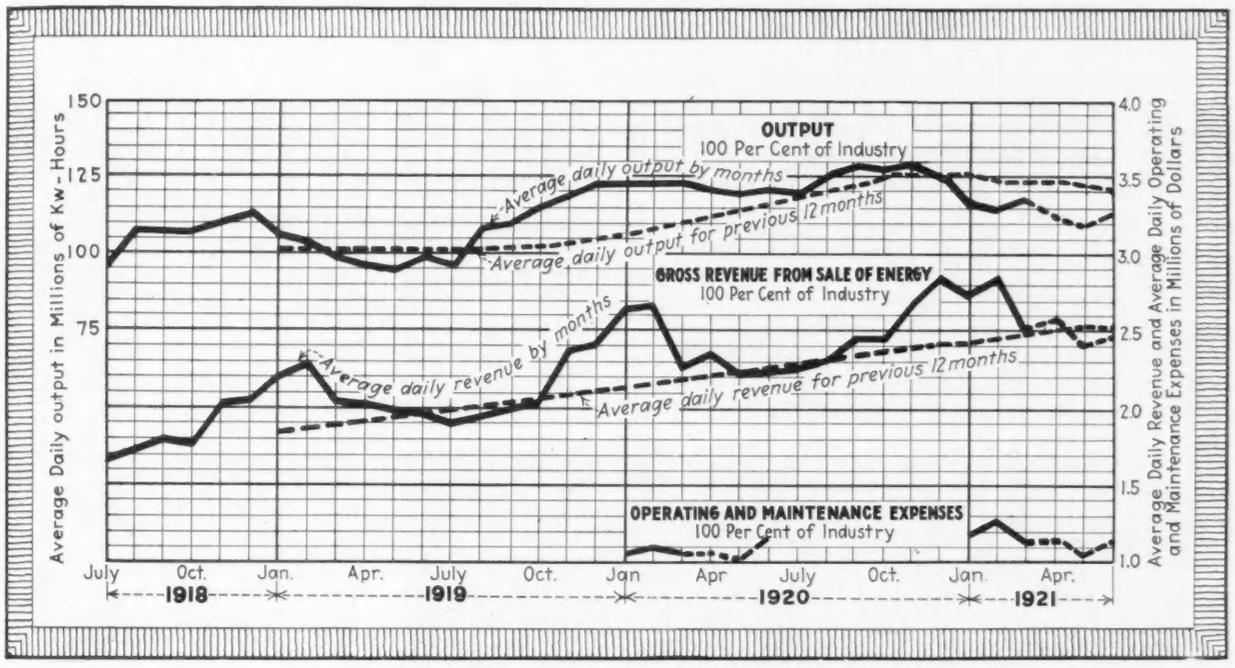


GROSS REVENUE, NET REVENUE AND BALANCE AFTER INTEREST PAYMENTS FOR TWENTY-THREE UTILITIES

operating expenses, and, second, because wages constitute a smaller item of operating costs than they do in the case of railways, and electric light and power companies have been largely relieved of this particular burden."

There is no form of business which is today in a sounder position than is the electric light and power business, the firm concludes, and well-protected securities of competently managed companies of this class constitute one of the soundest forms of investment.

Operating and Maintenance Expenses Materially Decrease



CENTRAL STATION OPERATIONS INCREASE DURING JUNE

REPORTS received by the ELECTRICAL WORLD for the month of June from central generating and distributing companies representing 78 per cent of the installed rating of the country indicate that increased operations were general in every section of the United States. A study of the returns for the past three years would lead to the conclusion that this upward swing in the amount of energy consumed is normal for the month of June. Industrial conditions appear to have remained generally stable during the month, and the increased output of the electric light and power companies is, with but few exceptions, probably due to an increased lighting load.

From an economic viewpoint the figures on revenue and operating expenses are most interesting. A comparison with returns received for June, 1920, indicates that while the total revenue for the month of June of this year increased by about $6,500,000, the operating and maintenance expenses, exclusive of interest, taxes, depreciation and sinking fund, actually decreased to a figure slightly below that reported for June, 1920. Similar relations held true for every section of the country, but were slightly exaggerated in the Atlantic States, where the revenue showed an increase of 15.2 per cent over June of 1920, while the operating expenses increased only 2 per cent during the same period. In January the electric light and power companies of the Atlantic States reported that their revenue for that month had increased by 15.3 per cent over that received for January, 1920, but during the same period their operating and maintenance expenses had also increased by 17.8 per cent. Such figures point in no uncertain way to the manner in which the electric light and power industry is sailing through the trough of general industrial depression left by the receding wave of prosperity. Reports of industrial conditions during June in the various sections of the country indicate that while there was a slight acceleration in some industries, there was

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1920 Thousands	1919 Thousands	Per Cent Increase
July	71	2,677,131	2,234,215	20.0	66	46,608	36,265	28.5
Aug.	71	2,769,175	2,303,099	20.1	66	47,410	36,713	29.1
Sept.	71	2,734,179	2,327,460	17.4	66	49,224	38,209	28.5
Oct.	71	2,797,625	2,499,488	11.9	66	51,370	41,055	25.1
Nov.	71	2,741,705	2,503,402	9.6	66	54,620	44,711	22.0
Dec.	71	2,792,554	2,648,746	5.4	66	57,697	48,580	18.6
		1921	1920			1921	1920	
Jan.	76	2,765,632	2,943,349	−6.0	70	58,855	50,861	15.8
Feb.	76	2,453,671	2,711,800	−9.4	70	55,540	48,633	14.3
Mar.	77	2,806,609	2,989,581	−6.1	72	55,513	49,071	13.3
April	78*	2,675,949	2,895,067	−7.0	72*	55,326	49,064	12.8
May	78†	2,668,455	2,889,141	−7.7	72†	53,900	47,930	12.6
June	78‡	2,674,693	2,888,449	−7.4	72‡	52,567	47,912	9.8

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting) 1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	OPERATING RATIO Steam Plants 1921	Steam Plants 1920	Hydro Plants 1921	Hydro Plants 1920	Combined Systems of Steam and Hydro 1921	Combined Systems of Steam and Hydro 1920
Jan.	40	14,562	13,085	11.3	56.1	55.3	26.8	27.0	38.1	45.6
Feb.	43	15,085	13,640	10.5	55.6	54.5	22.9	26.0	44.1	47.3
Mar.	53	18,757	17,248	8.7	56.1	57.7	23.4	19.6	40.2	44.8
April	53	17,815	16,641	7.1	53.0	56.5	23.9	19.8	41.4	43.3
May	53	17,274	16,727	3.1	55.4	56.8	24.2	22.9	40.6	44.8
June	54	18,665	18,675	−0.1	56.2	62.5	20.4	21.6	45.0	50.9

*Includes estimates for forty-five companies, representing 9.4 per cent of the total installed rating of allcentral stations.
†Includes estimates for fifty companies, representing 9.8 per cent of the total installed rating of all central stations.
‡Includes estimates for ninety-six companies, representing 18.6 per cent of the total installed rating of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States			
		Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase
KW.-HR. OUTPUT	July	82	190,668	159,000	20.0	66	881,241	714,485	23.5	74	841,351	702,302	19.7	56	138,937	106,460	30.1	79	614,934	551,959	13.4
	Aug.	82	194,028	171,002	13.5	66	905,170	728,097	24.2	74	891,712	750,787	18.6	56	147,082	111,573	32.0	79	631,183	541,640	16.5
	Sept.	82	194,730	170,593	14.1	66	905,872	758,737	19.5	74	878,237	758,017	15.9	56	147,524	113,649	30.0	79	607,816	526,464	15.5
	Oct.	82	196,310	191,132	2.7	66	964,739	841,694	14.5	74	896,241	817,757	9.5	56	157,267	126,769	24.1	79	583,068	522,136	11.7
	Nov.	82	193,231	183,624	5.4	66	953,436	825,011	15.5	74	895,229	861,352	10.5	56	144,889	125,438	15.0	79	554,920	507,977	9.2
	Dec.	82	210,494	227,403	-7.4	66	969,909	917,945	5.7	74	903,628	852,264	5.9	56	140,485	133,419	5.3	79	568,038	517,715	9.6
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	81	200,269	247,800	-19.2	77	1,003,223	1,043,650	-3.9	73	860,643	956,078	-10.0	62	144,936	145,336	-0.3	81	556,561	550,685	1.1
	Feb.	81	178,694	216,890	-17.6	77	902,030	970,539	-7.0	73	789,539	882,873	-10.6	63	131,654	132,537	-0.7	81	451,754	508,961	-11.2
	Mar.	81	205,348	230,309	-10.8	79	1,029,120	1,119,428	-8.1	73	894,500	941,893	-5.0	63	139,381	136,017	2.4	81	538,260	561,934	-4.2
	April	81	196,680	227,008	-13.3	79	963,659	1,052,716	-8.4	73	828,457	894,028	-7.3	63	132,075	135,421	-2.5	88	555,048	586,894	-5.4
	May	82	191,141	219,298	-12.8	79	934,971	989,375	-5.5	73	819,506	899,657	-8.9	63	136,573	138,416	-1.3	89	586,264	642,495	-8.7
	June	82	191,525	218,646	-12.4	79	941,368	1,004,019	-6.2	73	801,874	891,351	-10.0	63	135,629	134,649	0.8	89	604,297	639,778	-5.5
REVENUE			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	July	82	$5,009	$3,802	28.5	65	$16,899	$13,438	25.5	57	$12,822	$9,793	30.9	54	$2,747	$2,194	35.0	79	$9,131	$6,948	31.5
	Aug.	82	5,075	4,093	24.0	65	17,210	13,731	25.9	57	13,497	10,151	32.9	54	3,168	2,281	38.1	79	8,460	6,457	31.1
	Sept.	82	5,409	4,296	25.9	65	18,081	14,456	24.5	57	13,834	10,522	31.5	54	3,262	2,386	36.5	79	8,638	6,549	32.0
	Oct.	82	5,675	4,623	22.7	65	19,201	15,722	22.0	57	14,458	11,667	23.9	54	3,504	2,551	37.3	79	8,532	6,492	31.5
	Nov.	82	5,898	5,017	17.5	65	20,938	17,119	22.2	57	15,158	12,561	20.8	54	3,853	2,910	32.4	79	8,775	7,104	23.5
	Dec.	82	6,548	5,744	14.0	65	22,332	19,149	16.7	57	16,004	13,142	21.8	54	3,722	3,113	19.8	79	9,091	7,432	22.3
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	81	6,379	6,170	3.5	74	22,180	19,225	15.3	59	16,818	14,436	17.3	62	4,155	3,484	19.3	81	9,323	7,546	23.6
	Feb.	81	5,925	5,728	3.4	74	21,492	18,327	17.4	59	15,971	14,070	13.6	62	3,915	3,329	17.6	81	8,237	7,179	14.7
	Mar.	81	5,784	5,566	3.8	76	21,822	18,934	15.3	59	15,853	14,103	12.4	63	3,747	3,246	15.5	81	8,307	7,222	15.0
	April	81	5,665	5,554	2.0	76	21,504	18,609	15.6	60	15,506	13,822	12.2	63	3,744	3,312	13.2	88	8,817	7,767	13.6
	May	82	5,362	5,342	0.4	76	20,794	17,611	18.1	60	14,866	13,558	9.8	63	3,516	3,179	10.7	89	9,362	8,240	13.7
	June	82	5,265	5,366	-1.9	76	20,107	17,456	15.2	60	14,507	13,486	7.9	63	3,524	3,171	11.2	89	9,164	8,433	8.7
OPERATING EXPENSES:			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	34	$1,098	$1,288	-14.7	48	$6,373	$5,411	17.8	28	$3,941	$3,451	14.2	37	$1,015	$905	12.2	54	$2,135	$2,030	5.2
	Feb.	35	1,069	1,242	-13.9	53	6,799	5,937	14.5	29	3,958	3,445	14.8	44	1,217	1,053	15.5	55	2,042	1,963	3.9
	Mar.	45	1,576	1,651	-4.5	59	7,969	7,241	10.0	35	4,570	4,228	8.2	51	1,776	1,514	17.2	79	2,866	2,614	9.7
	April	45	1,418	1,479	-4.1	59	7,590	7,168	5.9	36	4,347	4,112	5.7	51	1,567	1,403	11.6	79	2,893	2,479	16.8
	May	48	1,548	1,577	-1.8	56	6,921	6,660	4.0	37	4,274	4,292	-0.4	52	1,563	1,486	5.2	81	2,969	2,713	9.5
	June	46	1,696	1,779	-4.7	56	6,933	6,804	2.0	39	4,772	5,102	-6.4	60	1,786	1,656	7.9	83	3,478	3,334	4.3

a corresponding further curtailment in others, resulting in almost a dead level, on an average, in the industrial load of the central generating stations. In New England textile mills showed decided increased activity during June, woolen and worsted mills operating at nearly normal and cotton mills at about 75 per cent capacity. The shoe industry also reported increased activity. Opposing this increased energy consumption was a material decrease in operations in the paper industry, due to strikes, and further production curtailment in the metal industries. It is probable that as a whole the industrial load of the electric light and power companies of New England was nearly stable, and that the slight increase in average daily energy consumption in that section may be attributed almost entirely to an increased lighting load.

The iron and steel industry of the Middle Atlantic States reported a greater depression during June than has been experienced in many years. Steel mills in the Pittsburgh district were operating at about 20 per cent of capacity, or 15 per cent below the average rate for the first six months of the year, and steel plants in the lake region of this section were operating only at from 10 to 20 per cent of capacity. On the other hand, the textile mills of the South Atlantic States increased operations from 1 to 6 per cent over May, despite serious strikes in some of the larger mills. It appears from the returns that the energy requirements of these

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

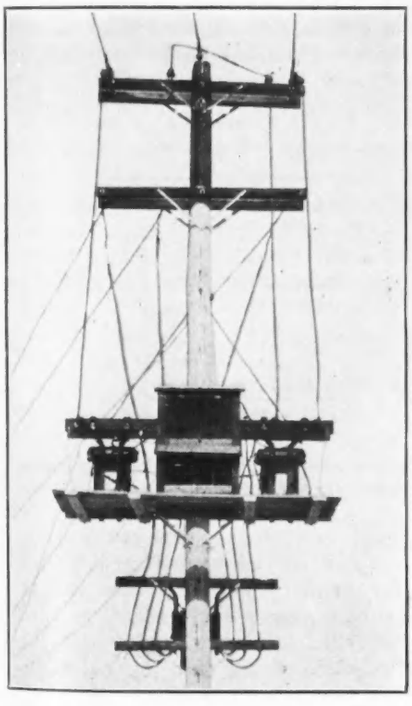
Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year			
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants:																				
January	54.0	60.8	54.0	60.8	53.5	50.9	53.5	50.9	61.2	61.8	61.2	61.8	53.1	53.7	53.1	53.7	69.0	60.5	69.0	60.5
February	54.3	59.5	54.2	60.3	52.3	53.0	52.7	52.1	63.0	57.9	62.1	59.8	59.1	51.2	56.2	52.3	60.2	60.3	64.3	60.3
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
June	60.1	71.2	58.7	64.9	55.8	59.5	53.8	55.3	56.6	68.3	58.3	61.8	55.3	60.0	54.6	53.8	53.4	56.2	58.6	57.8
Hydro Plants:																				
January	26.5	35.2	26.5	35.2	21.2	21.2	21.2	21.2	25.0	20.8	25.0	20.8	26.4	20.1	26.4	20.1	27.5	27.3	27.5	27.3
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27.4	20.5	23.9	27.9	26.0	27.6
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
June	29.2	21.5	26.6	33.8	17.6	18.8	19.0	19.6	21.1	19.5	22.8	20.2	27.3	18.3	27.1	20.7	30.3	27.4	27.6	24.2
Combined Systems of Steam and Hydro Plants:																				
January	45.3	53.5	45.3	53.5	43.5	45.8	43.5	45.8	39.5	38.6	39.5	38.6	38.6	46.6	38.6	46.6	35.2	45.6	35.2	45.5
February	44.3	60.0	44.7	58.8	41.8	41.9	42.6	43.8	42.4	49.8	41.9	48.2	41.7	39.6	40.5	42.0	39.6	43.8	37.4	44.7
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.0
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.3
June	58.5	56.5	49.6	53.2	42.3	45.8	41.6	44.9	50.1	62.2	45.0	51.6	45.1	44.8	41.3	42.7	38.8	44.3	37.0	41.1

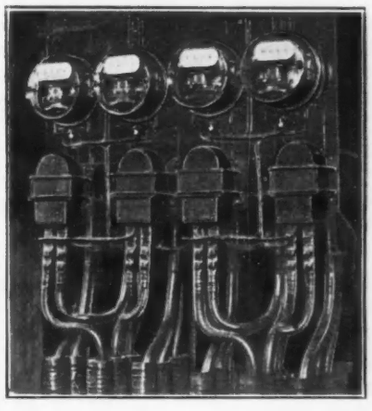
two major central-station customers about offset each other. Similarly the slightly increased energy requirements of the lumber industry were offset by a further curtailment in the shipbuilding industry. It appears probable, therefore, that the industrial load of the Atlantic States as a whole was about on a level with that reported for May, and that the slight increase in average daily output by the electric light and power companies of this section was the result of an increased lighting load throughout the section.

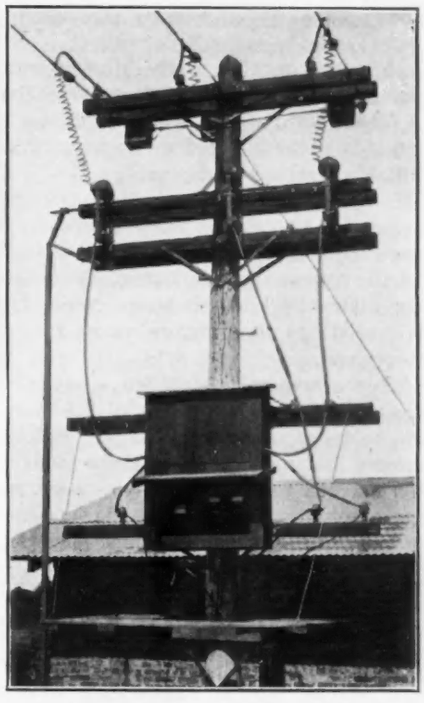
Industrial operations in the North Central States were virtually on a par with those during May. A slight decrease was reported by the iron and steel industry, and the automobile plants as a whole decreased operations by about 5 per cent under those reported for May. Activity in the copper-mining regions remained almost entirely suspended and the iron mines were operating on only part time. The textile industry was the only primary industry in this section which appears to have called for additional electrical energy, but a slight increase in the lighting load was also probable. The sum total of these various loads was that the electrical energy sold by the central generating companies of the North Central States was slightly in excess of that sold during May.

In spite of a cut in the iron and steel production in the Birmingham district and a material curtailment in crude-oil production, the average daily energy output in the South Central States was about 160,000 kw.-hr. in excess of that reported for May.

Operations in the mining sections of the Mountain States were still at a low ebb during June, the active mines operating on part time only. In the South Pacific section industrial operations appeared to be more nearly normal than during May, and almost every electric light and power company in that section reported increased energy requirements over those of May. In the Pacific Northwest the lumber industry reported increased activity, but other industries in that section were operating at about the same level as during May. The industrial load as a whole and the lighting load were slightly increased in the Mountain-Pacific States during June, resulting in an average daily output by the central generating stations of the section of about 1,400,000 kw.-hr. in excess of that reported for May.







LEFT AND RIGHT—TYPICAL PRIMARY METERING INSTALLATIONS. CENTER—METERING EQUIPMENT ON REAR OF TWO STATION PANELS

Improving Load Power Factor by Premium and Penalty

Discounts Are Allowed When Power Factor Is in Excess of 80 per Cent and Penalties Are Imposed for Lower Values—Methods of Measuring

BY LYNDON R. WILSON
Meter Engineer the Tucson Gas, Electric Light & Power Company, Tucson, Ariz.

PERHAPS no other problem has been thrust before the eyes of the central station industry lately in such a forceful manner as has the much-discussed question of dealing with the low-power-factor consumer. Its effects are felt by the majority of stations, both large and small, in a very decided manner, and probably in a manner far more serious than is actually realized by the average small station.

The latest definition of polyphase power factor may fill a much-needed vacancy, but how about measuring it? Shall one use the momentary power factor at the time of maximum demand as a basis, or should equipment be installed so that the power factor is integrated over a given period, thus giving the average power factor? Shall a penalty and premium be placed on loads below and above a certain power factor used as a basis? If so, what shall that basis be and what shall the penalty and premium be? Shall the rendered bill be figured on the reading of the watt-hour meter and a credit or penalty be taken care of as a cash discount or addition, or shall the indicated kilowatt-hour be altered

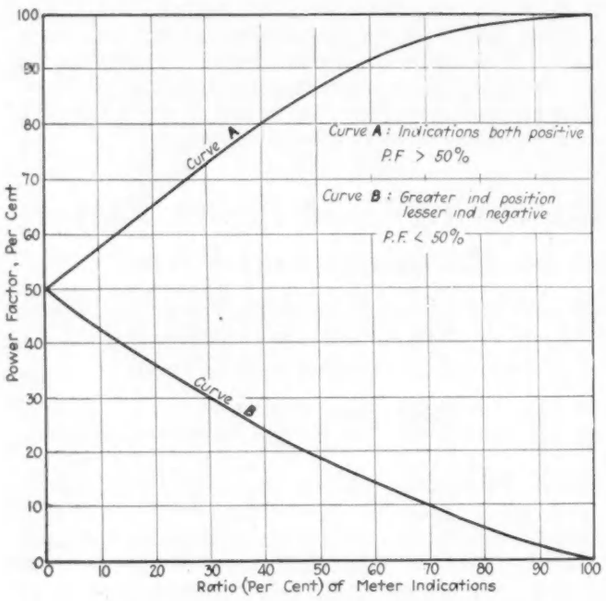
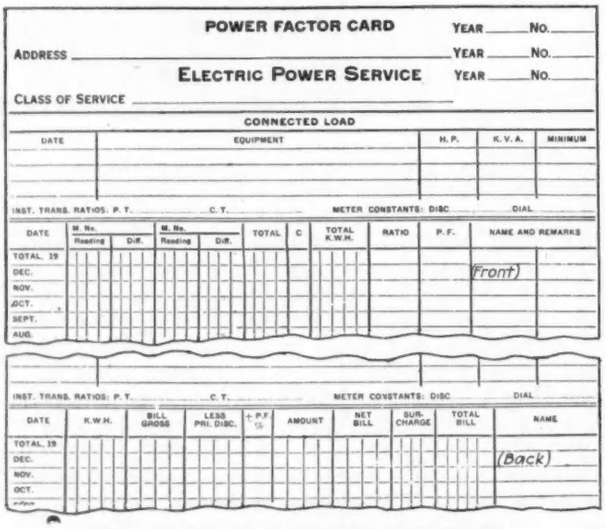


CHART FOR DETERMINING POWER FACTOR FROM INDICATIONS OF TWO SINGLE-PHASE WATT-HOUR METERS

to an approximation of the kilovolt-ampere-hour by the use of a multiplier dependent upon the power factor? In other words, the problem of dealing with power factor is a complicated one and simmers down to the available methods of metering.

If the load is balanced, then the metering becomes simple, for two single-phase watt-hour meters properly connected will register both the actual kilowatt-hours and the average power factor. The sum of their readings gives the kilowatt-hours, while from the ratio of their readings the average power factor can be readily determined.

After a somewhat detailed study of local conditions it has been found that most of the large loads are very well balanced, consisting largely of three-phase transformers and motors. For these loads it has therefore been decided to use two single-phase meters, with perhaps a polyphase meter as a check. On the loads which are not balanced two polyphase meters must be em-


POWER FACTOR CARD YEAR NO.

ADDRESS YEAR NO.

ELECTRIC POWER SERVICE YEAR NO.

CLASS OF SERVICE

CONNECTED LOAD

DATE	EQUIPMENT	H. P.	K. V. A.	MINIMUM

INST. TRANS. RATIOS: P. T. C. T. METER CONSTANTS: DISC DIAL

DATE	M. No. Reading	M. No. Diff.	M. No. Reading	M. No. Diff.	TOTAL	C	TOTAL K.W.H.	RATIO	P. F.	NAME AND REMARKS
TOTAL, 19										(Front)
DEC.										
NOV.										
OCT.										
SEPT.										
AUG.										

INST. TRANS. RATIOS: P. T. C. T. METER CONSTANTS: DISC DIAL

DATE	K.W.H.	BILL GROSS	LESS PRI. DISC.	+ P.F. %	AMOUNT	NET BILL	SURCHARGE	TOTAL BILL	NAME
TOTAL, 19									(Back)
DEC.									
NOV.									
OCT.									

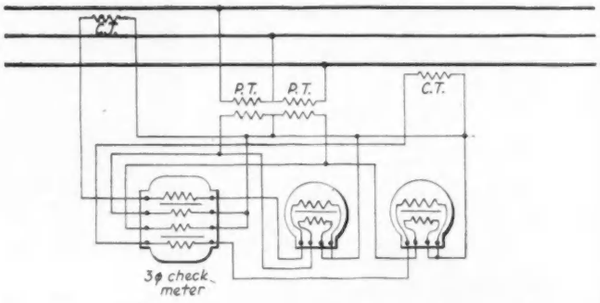
FRONT AND BACK OF PRIMARY SERVICE AND POWER FACTOR RECORD

ployed, one for measuring the active component while the other registers the reactive component. These, however, are in the minority.

To establish an incentive for improving power factor, it has been decided to demand an average power factor of 80 per cent, and if the power factor of any load is above this base value a discount is allowed amounting to 1 per cent of the bill for each 1 per cent that the power factor is above 80 per cent. For lower power factors a penalty of the same percentage is charged. Despite the fact that considerable opposition appears to have arisen to the discount allowance for power factors above the basic figure, it seems to the writer that such a method is the only really effective one to be used in approaching the average consumer of power.

If a few of the larger patrons find that they can secure an 8 or a 10 per cent discount on their power bills there is probably no better incentive for them to so alter their equipment or make whatever changes are necessary that their power factor may run around 90 per cent. A few such customers with such a power factor will result in a far greater benefit to the plant capacity than a much larger number of 80 per cent customers. In other words, the discount allowed for the high power factor will more than be annulled in added station capacity and, hence, in returns.

The solution of the power factor problem was car-



TWO SINGLE-PHASE METERS AND CHECKING METER CONNECTED FOR DETERMINING POWER FACTOR

ried still further in the case of the local company by the establishment of a new service record card devised to care especially for primary power consumers. A reproduction of the card is shown herewith. The card is similar to all other electric-service cards, with the exception that the two sides of the card are not alike. On the front are the two meter readings (the card being designed for two single-phase meters) from which the total kilowatt-hours is derived. By computing the ratio of the readings of the two meters and referring to the power factor curve, the average power factor for that month is an easy matter to determine. The total kilowatt-hours is carried over to the reverse side of the card and the gross bill figured; if the customer is under the primary power rate the customary discount of 5 per cent is deducted. The percentage penalty or discount is entered in the next column, as developed from the power factor determination on the front of the card. Columns for the surcharge and the total bill complete the card.

Without the power factor chart or table the calculations would be a tedious process, but by reference to them it becomes only necessary to determine the ratio of the lesser meter reading to that of the greater.

Both the table and chart are developed from the formula:

$$\cos\theta = \cos\left[\tan^{-1}\left(\sqrt{3}\,\frac{P_1 - P_2}{P_1 + P_2}\right)\right]$$

where P_1 and P_2 are the kilowatt-hour indications of the two meters.

In cases where the load is not balanced and it becomes necessary to employ active and reactive component meters the ratio of the two, of course, cannot be applied to the chart, since in this case the ratio of the two readings is the tangent of the angle whose cosine is the power factor.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Serious Objections to Dipping Lights to Flash Correct Time

To the Editors of the ELECTRICAL WORLD:

The editorial in the Aug. 6 issue of the ELECTRICAL WORLD on the Uruguayan "time dip" rather understates the benefits to be derived from this interesting but not entirely novel scheme. Flashing the time by a momentary cessation of service, at least in our crude Western communities, would certainly "make every citizen think once every day of the electric light company."

Hearty popular approval may be especially expected from the farmer, turning out to restart his pumps, with the alternative of losing a night's irrigation; from the motion-picture director, retaking a ruined scene; from the night crew at the new dam, digging the rocks out of the gyratory crusher, so that it may be restarted; from the surgeon, performing a delicate operation, as he sews up the results of the slip made in the moment of darkness; from the substation operator, getting the synchronous apparatus under way; from the naval radio station, repeating an interrupted message to Honolulu.

Think of the delightful "panicky kick" in the hotels and theaters, the lively stepping about in the gas works, the "verve" displayed in the cotton mill, and the bright smiles in the Maple Street Presbyterian Church as the organ kicks out during the wedding march and the bride stops en route to set her new jeweled wrist watch, the gift of her rich uncle from Spokane!

Not the least of the benefits will be the nightly test of the surge arrester, the reverse power relay, the undervoltage release, the overspeed trip and the nerves of the inductive interference committee.

And last, but by no means least, observe the central-station manager catching the midnight boat for extra-ditionless Uruguay, the land of courteous but not always continuous service.

L. M. KLAUBER,
General Superintendent.
San Diego Consolidated Gas & Electric Company,
San Diego, Cal.

Sparking Voltages

To the Editors of the ELECTRICAL WORLD:

I have read with much interest F. W. Peek's letter in your issue of June 18 (page 1427) in which he comments on a paper by the writer on sparking voltages. In that paper I analyzed, by calculating the disruptive stresses, the results of spark voltages given in the "Standardization Rules" of the American Institute of Electrical Engineers, which are in world-wide use. When the potentials of the electrodes are equal and opposite, the results prove in the most convincing way that this calculated disruptive stress has a constant value for a given pair of electrodes. Doubtless many other experimenters have noticed this. F. W. Peek's formula for this stress applies with wonderful accuracy both to his own experiments and to experiments with much smaller electrodes and apparatus carried out in different parts of the world during the last thirty years. We are, therefore, able to predict the spark voltages for any size of electrodes over a wide range provided that they are of equal size and that their potentials are equal and opposite at the instant of discharge.

When we come to the case where one of the electrodes is grounded, the disruptive stress appears to be variable, gradually increasing as the gap widens. If we make the apparently ridiculous assumption that the potentials at the instant of the discharge, instead of being E and zero, are $0.57E$ and $-0.43E$ respectively, then the disruptive stress is constant and Mr. Peek's formula still applies. It is puzzling to see any reason for this. I think that the mathematical formulas for the maximum electric stress can be applied with high accuracy. It is quite possible that the physical conditions in the interspace—the convection currents of electrified air, etc.—are so altered when one electrode is grounded that Mr. Peek's formula needs amendment.

The history of the discovery that for a given pair of electrodes not too close together the maximum disruptive stress at the instant of discharge is constant is instructive. The experiments made by William Thomson (Kelvin) in 1860 led him to prophesy that the disruptive stress would be found to be constant provided that the electrodes were not too close together. Later experiments by many physicists did not support this view. Schuster in a paper in the London *Philosophical Magazine* in 1890 showed that it was only a rough approximation. He, however, merely considered the case when the potentials of the spheres were E and zero. For the next fifteen years it was orthodox—at least in England—to think that the disruptive voltage was only slightly governed by the maximum electric stress. In a paper to the London Physical Society in 1905 in which the complete formulas were used the writer proved that in the case of 2-in. spheres the results obtained by different experimenters—notably by Steinmetz—made the disruptive stress constant over a very wide range. He somewhat hastily concluded that it would be found to be constant for spheres of all sizes. Further analysis of experimental results soon showed that the disruptive stress depends on the size of the electrodes.

In a further paper to the London Physical Society, read in 1910, on the stress at which ionization begins in air, the writer was led by the analogy of the corresponding thermal problem of the convection of heat from cylinders and spheres to conclude that the maxi-

mum electric stress would be given by an algebraical expression of the form $A + (B \div \sqrt{R})$, where A and B are constants and R is the radius of the cylindrical or spherical electrode. Applying this crude theory, he found that $32 + (9.5 \div \sqrt{R})$ gave all J. B. Whitehead's experimental results for a cylindrical wire (July, 1910) with a maximum inaccuracy of about 1 per cent. He failed, however, to make it agree with Kowalski and Rappel's experiments on spherical electrodes, which had then just been published. Later on Mr. Peek published the true formulas.

It will be seen that the ordinary electrostatic theory is only a help toward the solution of the problem. The disruptive stress, although constant for a given pair of electrodes, yet depends on their size, and simple theory no longer suffices. We have to consider the evaporation of the high-pressure electricity that takes places at the electrodes. It may well happen that the effects produced by evaporation of electricity from the insulated sphere only when the other is grounded may be appreciably different from the case where electricity is evaporating from both. Before accepting this, however, the writer wants to find out whether there is any explanation of why the spheres in the American experiments when one was grounded acted as if their potentials were $0.57E$ and $-0.43E$ respectively.

Having had experience in the use of an absolute high-pressure voltmeter in which the voltages are measured directly by the attractions between two electrified spheres, the writer has verified that these attractions depend on the absolute values of the potentials and are in strict accordance with electrostatic theory, although no special precautions are taken to keep the spheres at a great distance from neighboring objects. He is, therefore, loath to give up his belief that the maximum value of the stress is the governing factor which causes a disruptive discharge. Careful experimental results made with unequal spherical electrodes would probably settle the question. ALEXANDER RUSSELL.

Faraday House, London, England.

A Way to Eliminate Mystery of Watt-Hour-Meter Reading to Customer

To the Editors of the ELECTRICAL WORLD:

The dial indication of electric watt-hour meters was recently criticised quite severely by Harford Powel, Jr., Editor *Collier's Weekly*, and it appears that his point is well taken. The railroad timetable has nothing on our modern watt-hour meter when the average customer tries to read it.

Of course, central-station men try to educate their customers and instruct them in the correct reading of a meter, but how many of them ever learn well enough to be sure of themselves when they do attempt to read it? How many of our meter readers, in fact, are proof against errors in reading? Take a look at a meter with all four pointers on the 9's. How long does it take an experienced man to figure out what the meter actually reads? This test should be sufficient to illustrate that the meter reading is as much a mystery to customers as the cost mark on Chinese furniture.

The present trend in relations with the public is to invite the confidence of the customer. Stock is sold to him on easy payments, and he is invited to attend stockholders' meetings and to share in whatever earnings the company is able to make. Clerks are trained to make "friend customer" feel at home when he comes to the office and to let him know that his troubles are the company's troubles and that the company is just as anxious to give him a square deal as he is to get one. And yet we sell him appliances marked in watts, set up a meter marked in volts and amperes, take a look at the four dials which appear "out of joint" to him, and send him a bill for kilowatts!

Now, if it is impracticable to give the customer a meter reading directly in dollars and cents, we can at least give him a meter on which he can read the number of kilowatts used. Wouldn't he feel a lot better about it if the face of his meter were somewhat similar to the odometer on his car, for instance, with a regular register moving up from month to month and an additional "trip" register which could be set back at any time he might see fit?

The gas-meter people tried this once, but unfortunately chose an unreliable mechanism, and so they abandoned the whole idea. With the accurate and sensitive register mechanisms on the market today, why cannot our watt-hour meters be equipped with registers of this sort so that a customer can read his meter at a glance and know what it is doing? R. E. THOMPSON.

Deming Ice & Electric Company,
Deming, N. M.

Cost of Producing Power Low at Station of Springfield (Mass.) Company

To the Editors of the ELECTRICAL WORLD:

Since reading Mr. Sargent's article on page 216 in the July 30 issue of the ELECTRICAL WORLD we have selected at random a log sheet showing operating performance of our steam plant. The data presented prompt us to venture the opinion that the results we are obtaining average up well with efficiencies as shown by reports from other places. L. T. SCOTT, Manager.

LOG SHEET OF STEAM PLANT OF THE UNITED ELECTRIC LIGHT COMPANY

Date July 30, 1921

Boiler-hours in service	109
Banked boiler-hours	27
Pounds of coal weighed in	573,400
Pounds of water weighed in	5,020,000
Station output	265,000
Pounds of coal burned	510,391
Pounds of coal per kilowatt-hour	1.92
Pounds of water per pound of coal	9.83
Pounds of water per kilowatt-hour	18.94
Kilowatts per boiler-hour	2,431
Graphite used	6 lb.
Alum used	8 lb.

United Electric Light Company,
Springfield, Mass.

Palestine Being Electrified

To the Editors of the ELECTRICAL WORLD:

The development of the Holy Land is progressing considerably under the British administration, hydroelectric projects being reported on the Jarkon and Jordan Rivers. The one on the Jarkon River, in the region of Audscha, will be connected with a steam generating plant at Tel-Awiw for supplying domestic and industrial needs such as railway shops and irrigation loads. The plant on the Jordan will be rated at 30,000 hp.

It may interest ELECTRICAL WORLD readers to know that considerable American capital is being invested in enterprises in Palestine. HENRY L. GEISSEL.

Beaurivage, Thoune, Switzerland.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Steam-Flow Meters Show When Boilers Are Not Used Economically

A RECORDING steam-flow meter will help greatly in operating boilers at a certain percentage of their rated capacity in order to obtain the greatest efficiency. A boiler may be dirty, have a leaky setting, poor draft or a variety of other ills that may prevent its being worked to capacity. The steam-flow meter will show if this is the case. The following example serves to illustrate the usefulness of such a meter. It was found that the midnight-to-morning load of a certain central station should be carried on two boilers to obtain the most efficient results. Orders were therefore given the night chief to drop the boilers out gradually during the night as the load dropped off until the minimum of two boilers was reached. Apparently this was being done. Some time later, however, it was decided for various reasons to install steam-flow meters on all the boilers. After these meters had been in service a sufficient time to be adjusted and have dependence put on them it was immediately noticeable that the order was not being carried out. This gave rise to the suspicion that it never had been carried out faithfully. From the late night readings on the steam-flow charts it was easily seen that more than two boilers were in use all night. The chart of one boiler which was used all night did not show any noticeable rise in load in the late hours, when only two boilers should have been carrying the load.

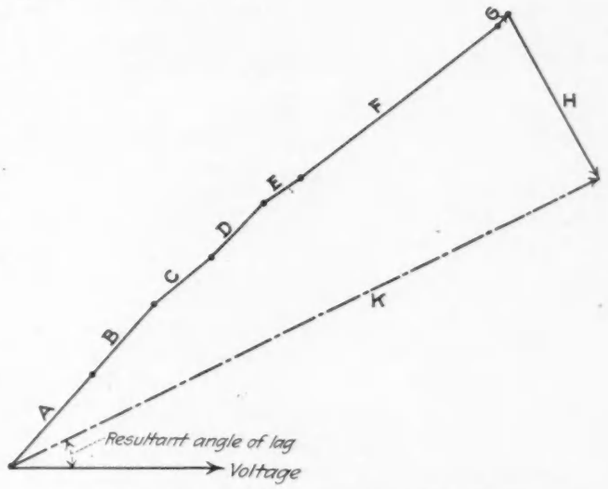
E. G. RALSTON,
Chief Electrical Engineer.
Indianapolis Light & Heat Company,
Indianapolis, Ind.

Analysis of Motor Load in 400-Ton Cyaniding Plant

A STUDY of the load requirements of a silver cyaniding plant that had originally been designed for 200 tons per day and gradually been increased to 400 tons per day revealed the fact that with twice the capacity the number of installed motors and the power required has not increased in proportion. This would seem to indicate that the mill was originally overmotored. However, a study of each individual drive showed that under wide variations of mill output the power required by some machines varied but little.

This mill, which is located at a large silver mine in Honduras, has been in operation for ten years. It is supplied with power from two hydro-electric plants and all motors of 15 hp. and over are operated on 2,200 volts. For the smaller motors and lights transformers are provided to give 110-volt service. The table on page 472 gives a list of the motors in use and follows the different stages of ore treatment in regular order. In a mill of this type the motor loads are quite steady, the mill load factor being quite high in consequence.

The two gyratory crushers at the head of the mill were originally each driven by a 25-hp. motor. Several years ago it became desirable to install a motor of the same size elsewhere about the plant. It was decided to run both crushers on one of the motors as the average load on each was barely 8 hp. A countershaft was accordingly installed and one motor belted to it has given satisfactory operation since. This is the only instance in the entire mill where there appeared to be a case of overmotoring.



POWER FACTOR IN 400-TON CYANIDE MILL REDUCED BY SYNCHRONOUS MOTOR DRIVING STAMPS

The power required for the stamps, of which there are twenty, weighing 1,850 lb. each, is not affected by the amount of ore put through them in a day, provided their speed is not changed. The quantity that can be crushed is dependent on the fineness to which it is desirable to crush the ore, but this is a purely metallurgical problem. The two synchronous motors used in this drive, one of which is for reserve, were originally alternators in an old plant. Their use for the stamp-battery drive has resulted in a great improvement in the mill power factor, as shown in the accompanying curves.

LINES SHOW CURRENTS TAKEN BY VARIOUS MOTORS

Letter	Motor	Ampere	Power Factor, Lag
A	Precipitation pump motors, shops and small motors	28	0.65
B	Rich-solution pumps	21	0.65
C	Compressor	17	0.76
D	Solution pump	17	0.68
E	Compressor and agitation and lights	10	0.84
F	Three tube-mill motors	57	0.78
G	Crusher	35	0.69
H	Synchronous motor for stamping	43	0.50 lead

The four classifiers were originally all the 4½-ft. size. With the introduction of two 6½-ft. classifiers to replace two of the old ones a 3-hp. motor had to be installed in

place of one of the 2-hp. motors, an increase of 1 hp. The three tube mills are carrying 400 tons per day with less load on the motors than when 200 tons was the output. A tube mill well loaded with pebbles and stems takes less power in general when once running than a lightly loaded one. In starting, of course, the torque required is greater, but the 75-hp. slip-ring induction motors, originally installed, have proved entirely satisfactory.

A 25-hp. motor was installed for the small compressor which was found necessary to aid the agitation compressor when the number of Pachuca tanks was increased. This motor also drives the four thickeners, of which there were at first only three, run by a 2-hp. motor.

It was found necessary to augment the three Aldrich triplex solution pumps with an additional unit, as the amount of cyanide solution carried was increased. A Cameron centrifugal pump being available, it was belted to a 20-hp. spare motor. These pumps serve to pump the overflow solution from the thickeners back to the top of the circuit, where it is used again in the stamps and tube mills. One of the Aldrich triplex pumps, No. 2, has a float switch to control the motor, an automatic panel being provided to start and stop the motor as the solution in the overflow tank varies.

Air agitation in the Pachuca tanks is taken care of by an Ingersoll-Rand compressor of the Imperial type driven by a 75-hp. motor. When the number of tanks was increased from six to eight it was found necessary to install an additional compressor. This is driven by a 25-hp. motor mentioned before. Following the Pachuca tanks are two mechanically agitated tanks driven by a 15-hp. motor and a storage tank driven by a 1-hp. motor. In this latter the movement of the rakes is very slow and only serves to prevent the slimes from settling to the bottom of the tank.

After leaving the filter presses, the rich solution is pumped up to the zinc house by the rich-solution pumps. When the mill was first built one of the Aldrich triplex pumps operating continuously and one intermittently were enough to take care of the load. One pump was then available as a spare. As the mill output increased it was found necessary to operate two pumps continuously and one intermittently.

The Crowe or vacuum process is a recent innovation at the mill and serves to reduce the amount of zinc dust necessary to precipitate the silver in the rich solution. A 3-hp. motor pumps the solution into a tank and the 2-hp. motor, belted to a vacuum pump, exhausts the air from the tank. After the zinc dust is introduced, three triplex pumps, called the precipitation pumps, send the precipitated material through five small presses, from which the precipitate is removed, dried in electric ovens and refined and cast into bars. Two ½-hp. motors are used for the blowers on the oil-fired furnaces. The 5-hp. motor in the slag house, belted to a small slag crusher, ball mill and Wilfley table, is only used several days a month.

INSTALLED MOTORS IN 400-TON CYANIDE MILL AND AVERAGE LOADS

Service	Machines Driven		Rated Hp. of Motor	Ave. Load, Hp.	Speed	Drive	Remarks
Crushers	2 A. C. Gates gyratory crushers, style K	No. 4	25	11	1,200	Belt	
Stamps	20 1,850-lb. stamps	.....	200	110	600	Belt	Synchronous motor
		.....	150	...	720	Belt	Synchronous motor, spare
		.....	35	...	600	Belt	Starting motor
Classifiers	2 6-ft. Dorr classifiers	.....	3	3	1,200	Belt	
	2 4½-ft. Dorr classifiers	.....	2	2	1,200	Belt	
Tube mills	3 5 ft.x22-ft. A.C. El Oro tube mills	No. 1	75	75	600	Flexible coupling	
		No. 2	75	75	600	Flexible coupling	
		No. 3	75	75	600	Flexible coupling	
Elevator	Pebble elevator	.....	2	2	1,200	Belt	
Thickeners	4 10 ft.x35-ft. Dorr thickeners 1 Small compressor for agitation	.....	25	20	600	Belt	
Solution pumps	3 Aldrich triplex pumps	No. 1	25	25	900	Flexible coupling	Pump: Size 10 in.x10 in., 115-ft. head
		No. 2	25	20	900	Flexible coupling	Size 10 in.x10 in., 115-ft. head
		No. 3	15	15	900	Geared	Size 6 in.x9 in., 115-ft. head
	1 Cameron centrifugal pump	.....	20	18	900	Belt	115-ft. head
Agitators	I-R compressor, Imperial type	.....	75	65	720	Belt	For 8-15x45-ft. Pachuca tanks
	2 Agitating tanks 10 ft.x35 ft.	.....	15	15	900	Belt	
	1 Storage tank 10 ft.x35 ft.	.....	1	1	1,200	Belt	
Presses	2 90-Frame Merrill presses	.....	3	...	900	Belt	Used only occasionally
Rich-solution pumps	3 Aldrich triplex pumps	No. 1	35	30	900	Geared	Pump: Size 6 in.x9 in., 314-ft. head
		No. 2	20	20	900	Geared	Size 5 in.x6 in., 314-ft. head
		No. 3	20	10	900	Geared	Size 5 in.x6 in., 314-ft. head
Crowe process	1 Centrifugal pump	.....	3	3	1,800	Belt	
	1 Vacuum pump	.....	2	2	1,200	Belt	
Precipitation	3 Aldrich triplex pumps	No. 1	20	20	900	Geared	Pump: Size 5 in.x6 in.
		No. 2	15	15	900	Geared	Size 6 in.x9 in. Low pressure
		No. 3	20	5	900	Geared	Size 5 in.x6 in.
	Zinc mixer	.....	½	...	1,200	Belt	
Refinery	Blowers on furnaces	No. 1	½	...	3,600	Direct	Used only a few hours daily
		No. 2	½	...	3,600	Direct	
	3 Electric precipitate-drying ovens—equivalent	.....	.....	25	.....		
Slag house	Crusher, ball mill and Wilfley table	.....	5	...	720	Belt	Used only several days per month
Totals			987½	662	Number of motors	31	

It will be seen that, aside from utilizing two spare pumps and installing an additional one, very little extra motor load was connected in as the mill production increased. True, all machines were operated more hours per day with the result that the average mill load has increased from approximately 400 kw. in 1913 to 500 kw. in 1921. With an output more than doubled (the mill has averaged in excess of 400 tons per day recently) the average power consumed has increased but 25 per cent. The power consumption of nearly 30 kw.-hr. per ton of ore milled compares favorably with that of other mills of this type and size.

The discrepancy between the load shown by the table and the power-factor curves is due to the fact that the latter cover the whole mill substation load, which includes the shops, laboratory, sawmill and lights.

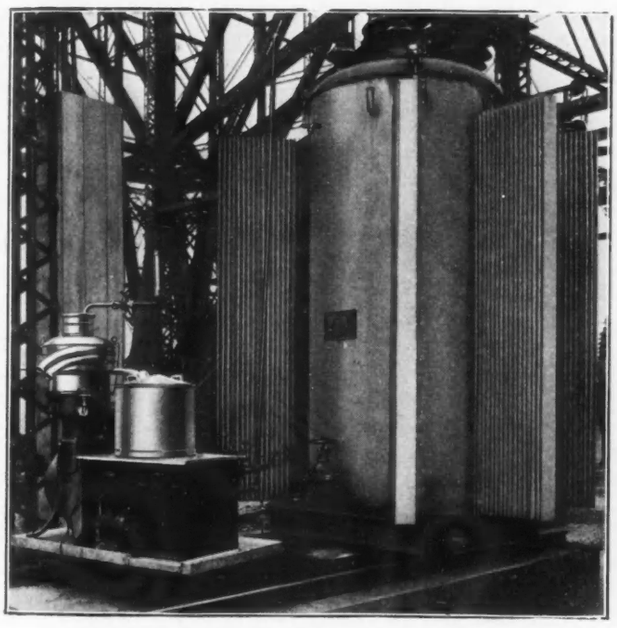
FREDERICK KRUG.

New York & Honduras Rosario Mining Company,
San Juancito, Honduras, C. A.

Dehydration of Transil Oils by Centrifugal Force

SUCCESSFUL operation in many central stations of centrifugal oil purifiers to remove water and dirt from used lubricating oil has resulted in the manufacture of these machines for dehydrating transformer oil. This centrifugal purifier is guaranteed to deliver an oil having a dielectric strength of at least 40 kv. (old-style test cup) or 22 kv. (new-style test cup). Although this is the guaranteed performance of the machine it has been found in service that the oil passed through it will consistently test considerably higher, some individual tests running as high as 55,000 volts (old-style cup).

In the operation of the centrifugal oil purifier the oil is drawn from the bottom of the transformer and is pumped through an electric heater to the top of the purifier. Moisture and other impurities are removed in the bowl of the machine by centrifugal force, and the



CENTRIFUGAL OIL PURIFIER RAISED BREAKDOWN VOLTAGE FROM 13 KV. TO 25 KV. IN 145 MINUTES

pure oil delivered from the outlet is pumped back into the top of the transformer. The pumps which are necessary to handle this oil, as well as the electric heater which is used to increase its fluidity, are provided as a part of the portable outfit described later on.

As an example of the performance of this machine it is interesting to note the results obtained in a recent test at the Central Hudson Gas & Electric Company's plant, Poughkeepsie, N. Y., on a 1,500-kva. transformer holding 1,200 gal. of oil. The installation of the machine for this test is shown in the accompanying illustration. The oil in this transformer tested at 13,000 volts, using the new standard gap. As soon as circulation of the oil was started the oil from the machine delivered to the top of the transformer tested consistently at 25,000 volts. Circulation was continued for two hours and twenty-five minutes at the rate of 375 gal. per hour. At the end of this time oil from the bottom of the transformer could not be broken down at 25,000 volts even though the potential was maintained in the test cup for periods of longer than five minutes at a time.

Although the character of the oil does not affect the thoroughness of dehydration, it does affect to some degree the capacity of the machine in that burned or emulsified oil should be run at a lower rate. On ordinary oil which has not become burned or emulsified a capacity of 300 gal. per hour can be obtained from the large-size machine. A smaller-size machine is made which gives a normal capacity of 100 gal. per hour. Under normal conditions the machine will dehydrate from 2,000 gal. to 3,000 gal. of oil before it becomes necessary to clean the bowl.

This purifier can be installed for stationary service or mounted on a truck containing all the necessary auxiliary equipment connected up for immediate use. To purify the oil in the transformer it is only necesary to make two pipe connections and one electrical connection. Short lengths of flexible hose are employed to make pipe connections to and from the transformer. The same machine can be used also for cleaning up batches of lubricating oil.

The general construction of the machine is similar to that of the centrifugal apparatus used to purify lubricating oil. Under ordinary conditions of service the machine is used as a clarifier only, discharging pure oil, and all the moisture and sediment are retained in the bowl.

Where the oil is emulsified or a large amount of free water is present, the substitution of a part in the bowl converts the machine into a purifier or separator which permits both water and pure oil to be discharged through separate spouts. The sediment in either case is retained in the bowl. When either of these types of bowls is used, however, there is an extra cover on the machine, known as the overflow cover. In case the bowl of the machine becomes clogged or the amount of oil fed into it is greater than it can properly handle, the oil is discharged from this spout. This construction eliminates all chance of having to put the entire contents of the transformer through the machine again because of wet oil becoming mixed with that which has been dehydrated.

C. H. HAPGOOD,
De Laval Separator Co., Engineering Department.
New York, N. Y.

Selecting Lamps for Flood-Lighting

BEST results in flood-lighting depend mainly on selecting the correct number of lighting units and the correct type of projector. To demonstrate how the proper choice may be made, the curves and tables reproduced herewith will prove helpful. These show the four common types of flood-lighting units made by one manufacturer. The different types of lamps have beams which diverge at different angles, the smallest being 11 deg. and the largest 50 deg. The first two units come regularly equipped with 500-watt lamps, the third unit with a 250-watt lamp and the last unit with a 1,000-watt lamp. For each type there is a chart which tells how many projectors will be required to illuminate a certain area in square feet to a certain foot-candle intensity.

As an example to explain the method of using the charts, suppose that it is desired to flood-light an area of 40 ft. x 100 ft. (4,000 sq.ft.) located in the residential section of a town and that the surface is medium dark in color and flood-lights can be placed at a distance of 25 ft. Referring to the line just under the drawings of the lamp, it is seen that the lamp suitable for 25 ft. distance is the projector *B*. From the table of inten-

sities for flood-lighting it is noted that for lighting medium-colored buildings in a residential section 10 foot-candles is the necessary intensity. Referring then to the chart underneath lamp *B* and to the 10 foot-candle curve upon this chart, it is found that for 4,000 sq.ft., approximately thirteen projectors will be necessary to furnish the proper illumination. Other problems may be worked in a similar manner.

In using the chart the angle between the axis of the beam and the lighted surface must not be less than 70 deg. The working distances are given for convenience in selecting the proper projectors. Local conditions may sometimes require a change. It must be noted that in some cases more than one type of projector might be used for the same purpose. For instance, if the working distance were 100 ft. type *A*, *C* or *D* might be used. Local conditions will determine which unit is best such as the width of the surface to be illuminated, etc. It must also be remembered that the lamps of higher wattage are more efficient and consequently their operating cost will be less for a certain intensity of illumination. This and the first cost of the equipment and wiring and the cost of cleaning must all be considered where there is a choice of more than one type of reflector.

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General Electric Company,
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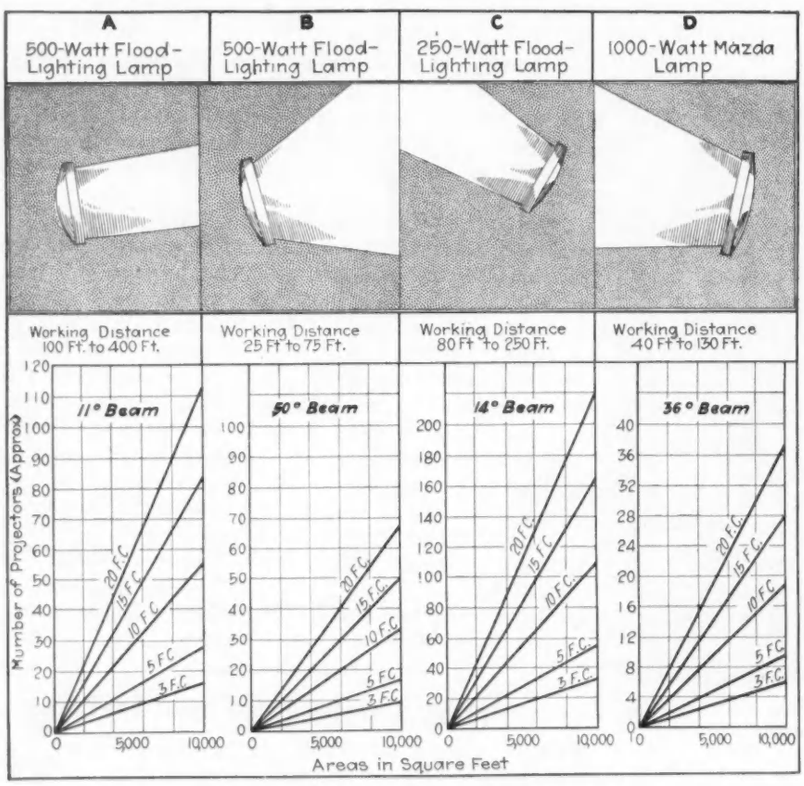


TYPE AND NUMBER OF FLOOD-LIGHTING UNITS DETERMINED BY THIS CHART

In using this chart the angle between axis of beam and surface lighted must not be less than 70 degrees. Working distances are given for convenience in selecting the proper flood-lighting projector. Local conditions may necessitate a change in some cases.

TABLE OF INTENSITIES FOR FLOOD LIGHTING

	Character of Surroundings		
	White Way, Foot-Candles	Residences, Foot-Candles	Parks, Foot-Candles
Dark colored buildings	20	15	10
Medium colored buildings	15	10	5
Light colored buildings	10	5	3

Some Experience with Overhead Ground Wires

A SUMMARY of experiences with overhead ground wires was presented in a recent committee report of the Northwest Electric Light & Power Association. The report states that although the conclusions are only partly decisive, the net effect of deduction from these records is to place a serious question against the practice. Despite certain instances where considerable benefit has been indicated, the bulk of experience with it has been negative or inconclusive.

On the other hand, experience does not indicate that the troubles directly occasioned by overhead ground wires are necessarily serious, or at least that the problem of reducing them to an inconsiderable amount is unsurmountable. This minimization of troubles may, however, involve considerably more expensive construction than hitherto has been the practice in the way of increased size of overhead ground wires, increased strength of fastenings and increased clearances. It is believed that many of the troubles experienced would have been avoided by reasonable care in inspection and maintenance.

Where the policy of a high degree of conservatism in plant design is maintained the logical practice would probably be to continue the use of overhead ground wires. However, it would seem justifiable, as a general procedure, for a company which has hitherto used overhead ground wires as standard practices to omit them from at least a portion of future construction. For a company whose policy has been not to use overhead ground wires and whose experience with lines so constructed has been reasonably satisfactory the record of experience available does not warrant a change in policy.

A summary of the records showed that overhead ground wires do afford a certain protection to insulators. Quantitatively, however, the extent and value of this protection are not determined. They do not afford any appreciable protection to wooden poles in addition to that given by individual grounding wires on each pole, except possibly in regions where grounding conditions are exceptionally poor. There is evidence that they do afford protection to station apparatus. They tend to give better relaying conditions on systems with grounded neutral. Their value in this respect will depend upon type of relays employed, individual ground connections and other local conditions. They add to the longitudinal stiffness of transmission line structures when attached directly to the structure, and to a small extent when carried in a bayonet or crossarm. The extra wire, however, increases the wind and ice loading on the line.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Strap Coils Reinsulated with Cotton Sleeving to Save Time

BY USE of cotton sleeving to reinsulate the strap-copper coils, a rotary converter which burned out recently was put back in service in a very short while. This was a 600-volt (direct-current) 300-kw., 1,200-r.p.m. machine with ninety-six coils. The coils were 27 in. long by 12 in. wide, with slot sections 13 in. and 14 in. long. Each coil consisted of three straps of 0.064-in. by 0.25-in. double-cotton-covered ribbon wire. The insulation on the individual wires was so badly scorched that new coils had to be made, or the wires reinsulated. Not having any of this wire in stock, and as the coils were not bent out of shape, it was decided to reinsulate them. They were then put into a boiling cleaning solution and left for five hours. After they were removed and rinsed in clean water the old insulation came off easily.

Upon trying to tape the individual straps it was found very hard to keep the coil in shape as the weight and tension on the taping reel bent the straps. To avoid this and still use the reel meant lost time, as the tape would have to be applied slowly.

At this point cotton sleeving was thought of and when a length was tried it slid over the strap with ease. The method seemed to solve the problem, so all the straps were reinsulated with the tape. A pointed horn was made out of tin that would just fit over the end of the strap, and tapered down to a blunt $\frac{1}{8}$-in. point. This eliminated filing the ends of the straps to prevent the sleeving catching on the corners. The sleeving was cut into lengths that would reach to the middle of the diamond point at the rear end of the coil, two pieces being required for each strap. The two ends of the sleeving were taped at the place where they met with 0.004-in. cotton tape, while the lead ends of the sleeving were glued down. The two outside straps only were sleeved, the middle strap being left bare, except around the diamond point and leads, which were taped with 0.004-in. by $\frac{3}{4}$-in. cotton tape half-lapped. This taping extended into the coil 3 in. The three straps were then taped together with 0.004-in. by $\frac{3}{4}$-in. cotton tape spaced, and dipped in plastic varnish, the coils being allowed to soak in the paint, after which they were baked.

Before proceeding with the complete set one coil was insulated but not dipped, and then tested between straps. The coil did not break down when 1,200 volts alternating current at 60 cycles was applied for three minutes.

After dipping, a $2\frac{1}{2}$-turn mica and fishpaper wrapper was applied to the slot section. The ends were taped with one layer of 0.008-in. by $\frac{3}{4}$-in. treated-cloth tape, half-lapped, this tape extending onto the slot section $\frac{3}{4}$ in. A layer of 0.007-in. by $\frac{3}{4}$-in. cotton tape was then applied half-lapped on the ends and spaced on the slot section, and then the coils were dipped in clear varnish and baked.

The coils reached the shop on Friday noon, and were sent out the Monday morning following. They were boiled Friday afternoon and one man stayed until 9:30 o'clock and cleaned and tinned enough coils to start insulating Saturday morning. The coils were all cleaned, leads tinned, sleeved, taped together and first dipped Saturday; on Sunday three boys finished the last taping and dipped the coils.

The cotton sleeving saved about four days that would have been required if the ordinary method of insulation had been employed and the machine has run satisfactorily ever since.

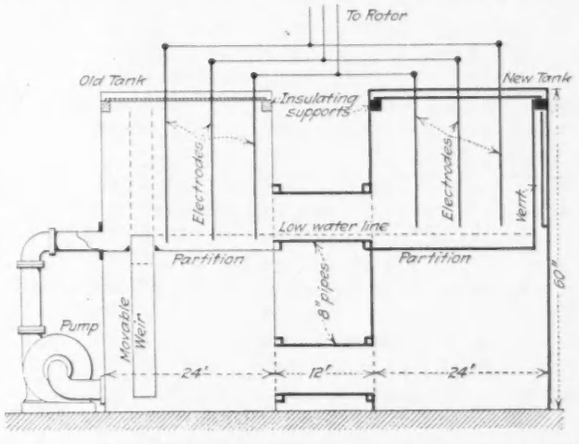
A. C. ROE.

Detroit, Mich.

Liquid Rheostats Rebuilt to Increase Hoisting Speed

AT ONE of the coal mines of the Union Pacific Coal Company of Wyoming difficulty with the liquid rheostat used for controlling the hoist motor was experienced in that the proper resistance for giving gradual acceleration was too great to permit the motor to run up to full speed. When the resistance of the solution was decreased to permit full-speed operation the rate of acceleration was too great when taking up slack rope, making it necessary to apply the hand brake to prevent the first car being derailed. After numerous trials no one solution density was found which gave all of the results desired. The difficulty was finally overcome by the addition of an auxiliary tank to the original tank, as shown in the accompanying drawing.

The new tank was connected to the old by two 8-in. pipes, one connecting the upper chamber and one the lower chamber. In starting, only the plates of the original tank are in contact with the solution and easy acceleration is the result. At "full on" position of the weir all plates are submersed.



EASY ACCELERATION WITH FULL SPEED ACHIEVED BY ADDING EXTRA TANK TO LIQUID RHEOSTAT

The rheostat is used to control a 400-hp. motor hoisting up a slope 7,500 ft. long on a 6-deg. pitch. When purchased, the hoist was supposed to have a rope speed of 1,500 ft. per minute, but it was found that a maximum of only 1,300 to 1,350 ft. per minute was reached. The motor speed originally reached a maximum of 510 r.p.m., which was equal to 15 per cent slip, although the name-plate rating was 575 r.p.m. With the additional tank the rate of speed of 575 r.p.m. is reached and the mine tonnage is increased 150 tons per day. The tank is made of $\frac{1}{4}$-in. steel plate and measures 24 in. x 60 in. x 60 in. Most of the welding was done with an electric arc and the total cost of the new tank installed was approximately $300.

D. C. MCKEEHAN,
Chief Electrician.

The Union Pacific Coal Company,
Rock Springs, Wyo.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Functions of Modern Sales Department of a Central-Station Company*

By T. I. Jones
General Sales Agent Brooklyn Edison Company, Inc.

OUR industry is a comparatively young one. Only forty-one years ago the first commercial application of Edison incandescent electric lighting appeared, and but thirty-nine years ago the first commercial central station was equipped. During the early stages of our development the energies of central-station companies were of necessity directed to the engineering side of our business and the perfection of ways and means of manufacturing and distributing our product. While it is true that this engineering period is by no means ended and that much work along these lines remains to be accomplished, our principal endeavor now is to devise ways and means to market our product. It is our duty so to perfect our organization that we may make and pursue plans of organization which will produce similarly efficient commercial results.

Let me be specific. As the engineer has all to do with the development of the technical side of our business, so should the sales manager's efforts be centered on all that relates to our commercial activity. If we men in charge of the commercial activities of our companies have the conception that these activities should be limited to the signing of applications and canvassing for wiring contracts, the result must be that we shall surely become a small and decreasingly important element in our organizations. Not only will we fail to progress, but we must atrophy, for development in our modern complex civilization follows the law by which the blacksmith's arm grows strong with use while the gloved hand of the idler becomes white.

Commercial Functions Increase

On the other hand, if the conception of our functions and possibilities is broad, coterminous only with the superintendence and direction of all the public relations and activities of our companies, then at the present stage of central-station development we are bound to grow and become an important factor in our organization. The characteristics and conditions of our industry vary, and our conceptions and activities must vary accordingly. It is my contention that at the present stage of development the conditions are such as call for the widening and broadening of the activities of our commercial departments, and we must either step forward to meet the situation or else take a back seat for a long time to come.

When the time arrived at which it was possible to generate electricity in large blocks and distribute it economically and efficiently, the urgent problem was how to dispose of the product profitably. This was the real beginning of the sales department. It was required to inform and educate the public, to develop new uses for electricity, to devise contracts and rates, to organize and direct salesmen and sales campaigns, to create and publish proper advertising—to perform all three of the sales and advertising director's tasks—arouse interest, create desire and intensify desire into resolve to buy. Our energy during this era was principally devoted to convincing managers of large enterprises of the superiority of electricity over any other motive power and that they could buy energy from us cheaper than they could generate it; or to convincing storekeepers that they could use electricity in their businesses to their great advantage; or to convincing householders of the desirability and attractiveness of electricity for lighting and other household requirements.

Financing and Public Relations

While it is true that this period is by no means ended and that much work along the lines indicated remains to be accomplished, there has been within the past few years another shift, so that the most important problems that confront the industry today are those connected with financing and public relations. By public relations I mean two things—first, the arranging of our conduct, the marshaling of our methods and the training of our forces so as to create the right kind of contact between our organization and the public, the kind of contact that will result in a minimum of friction and a maximum of good will; second, the presentation to the public of our communities in a convincing way of the facts in regard to the operations and methods of our companies—the reasonableness of our rates or the requirement for higher rates, the logic of our practices, and our side of all those questions which as public service corporations we encounter and upon which it is to the mutual advantage of company and public that the latter have accurate knowledge. We cannot be sure of fair play—our future is not safe—until this is done, and for some time to come, until the public is informed on such questions from the standpoint of the central-station company, and until our forces are so organized and trained that we can handle our business with the public satisfactorily, this is going to be the most important work before us. As a matter of fact, its importance cannot be overestimated, as our future depends upon it.

It is my contention that the work done by our sales departments during the past ten or fifteen years has equipped us to do this larger commercial relations work better than any other department or element of our organizations. As a matter of fact, outside and beyond the sales department, what department of the average central-station company *has* dealt largely with the

*A paper read at the Sales Managers' Association Convention, Association Island, N. Y., July 18, 1921.

public in such a way as to fit its personnel to handle such delicate and important relations? The question answers itself. The burden and responsibility must be ours. So I feel that we must either organize ourselves to handle our job in a big way or else step aside for some one who can and will. We must have a big conception of our department as one in which are concentrated not only all the business-getting activities, including the advertising, but, as set forth in the address of the chairman of the Commercial Section at the recent N. E. L. A. convention, such public relations activities as the campaign sale of company securities to the public, wiring and service inspection work which brings the employee in contact with the applicant and the contractor, the handling of complaints, the dealing with inquiries as to delayed service, incorrect accounts and high bills, including the making of necessary adjustments, and the engineering of cooperation between the company and other elements in the electrical business; in fact, the handling of all publicity relations. This will make for a unity hitherto impossible and for a very desirable minimizing of the number and variety of employees.

You can see that the title "sales department" is a misnomer as applied to all this work. The correct title, it seems to me, should be "commercial department," and the man in charge should be "general commercial manager." I believe the time is coming, if we see this matter in the right light and act accordingly, when the head of such a department will be a vice-president in charge of commercial relations and activities. This has been the tendency for some time in many business organizations. Witness those banks which have enjoyed development and expansion during the past five or ten years—you will find in many cases a vice-president in charge of the commercial activities of these institutions. Such a man in our companies would be an important part of the executive direction of the organization, competent to advise and assist in all matters connected with rates, customer questions, relations and transactions with public service commissions and city and state officials, sale of securities and such problems.

This means responsibility and plenty of work. It means that while we must not neglect the selling of our service both in large and small ways, while we must continue to originate campaigns and produce profitable business, we must also extend our activities to new fields and must train and direct an expanded force, so that all public relations shall be safe in its hands and it can be trusted to develop and conserve public good will. I hope to see our new commercial department taking its proper place in the new order of things, coming gradually to handle all functions and activities of our companies in which there is direct dealing or relationship with the public.

Citizens, City Officials and Utility Men Meet and Talk Things Over

A PRACTICAL example of the friendly spirit of cooperation that should prevail between cities and utilities is to be seen at Clinton, Ind., where the Chamber of Commerce recently held a public meeting at which the question of electric light and power service was discussed by private citizens, city officials and officers of the Wabash Valley Electric Company. At this meeting the citizens told what they thought of the service, city officials discussed the rates, and company officers spoke of their plans for extensions and improvements. The result has been that all three factors contributing to the success of public service are now in sympathy. Each knows the problem of the others. Officers of the company took occasion to explain that its earnings can in no case become excessive, dwelling on the ruling of the Public Service Commission granting a rate that allows something less than 7 per cent return. This return, it was hardly necessary to point out, is less than the current rate of interest at the local bank.

This meeting proved extremely interesting alike to the citizens, the city officials and the utility men, as was evidenced by the number and character of the questions and the active discussion that developed. It has undoubtedly produced a far better mutual understanding.

From Here and There

Chicago, Ill.—At the "Pageant of Progress" exposition which opened in Chicago on July 30 the Public Service Company of Northern Illinois installed in its exhibit a large map showing the location of its stations, electric and gas, its lines, the communities it serves and the nature of the service performed in each town. It attracted much attention, and representatives of the company were on hand to explain the details to all inquirers.

Spokane, Wash.—The Washington Water Power Company by consistent range campaigns for the last few years has developed one of the largest electric cooking loads in the country, with nearly 3,200 ranges connected, representing a load of over 20,000 kw. The company has a cooking rate of 3 cents and has found that the sale of an electric range and water heater raises the monthly income from the average home from $1.40 for lighting only to $8.50 for light, range and water heater. This company has found that ranges have such a diversity factor that each one can be reckoned as a 1⅓-kw. load, though rated in connected load as 6.5 kw. It is expected that the number of ranges in use in Spokane by the end of 1921 will be fully 10 per cent greater than at the end of 1920.

Pittsburgh, Pa.—The manager of the trade and industrial bureau of the Chamber of Commerce of Pittsburgh has recently made a wide distribution of a circular letter on the subject of power and fuel. This letter was addressed to manufacturers throughout the country and suggested that if their expansion program contemplated branch plant locations, Pittsburgh offered ideal conditions. The letter was printed as a four-page folder, the center spread displaying a map of the Pittsburg district on which were indicated the power houses and main transmission lines of the two local operating companies, the Duquesne Light Company and the West Penn Power Company, with reproductions of ten photographs of the stations and other service equipment of these companies. On the front page were statistics and testimonials on the power and fuel resources of the "Steel-Electric City," as it is now called.

Digest of Electrical Literature

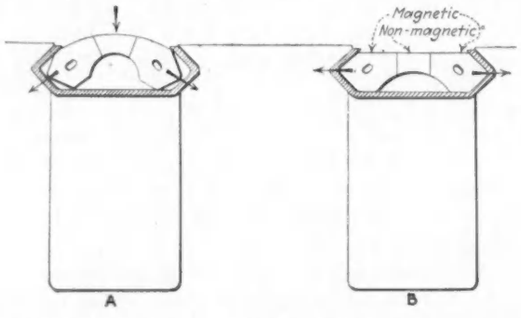
Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Electric Starters for Gas and Gasoline Engines.—M. DIGEON.—Directions are given in this paper for the proper choice of the size of a starting motor for small (automobile), medium and large gas engines, taking into consideration the necessary torque, minimum starting speed and gear ratio.—*Revue Générale de l'Electricité*, July, 1921.

Protective Features of Motor-Control Equipment.—H. D. JAMES.—A description of the operation of different types of motor-control equipment.—*Power*, Aug. 2, 1921.

Laminated Steel Wedges to Close up Slots in Three-Phase Motors.—M. J. ILG.—To insure the best electric characteristics on three-phase motors the semi-closed type of slots must be used. This complicates the construction of the coils, as they cannot be form-wound and machine-pressed, which would be possible only with fully open slots. Several attempts have been made to close the open slots with wedges of iron, but all of them have failed, because either the solid wedge caused additional eddy losses or else the wedge did not stand up under continual hard service, became loose and damaged the winding. A new style of magnetic wedge is described of which half a million have been used with excellent results. The new wedge is built up of steel laminations insulated from each other as is usual in alternating-current machinery. The form of the wedge is similar to a toggle joint and resembles a semi-closed slot, consisting of two toggles of magnetic material and



MAGNETIC WEDGE TO CLOSE SLOTS IN THREE-PHASE MOTORS

a non-magnetic middle piece. The finished wedge is insulated at the sides and the bottom and inserted into the open slot, and by a few blows with a hammer the middle part of the wedge is driven down, thus separating the toggle. This sets the wedge exceedingly solid. Several illustrations of this wedge are given.—*Siemens Zeitschrift*, June, 1921.

Resonator, Dissonator and Quench Transformer.—G. BENISCHKE.—Much has been written recently about means to diminish the flow of current during a "ground." Some have advocated the use of resonating circuits; others have suggested the opposite way, that is, dissonating circuits. It has also been contended that dangerous resonance may occur with the use of a so-called "quench transformer." The author endeavors to throw some light on these vexing problems by mathematical investigations and comes to the conclusion that every generator and transformer has, so to speak, a natural dislike to come into resonance with its own fundamental frequency.—*Elektrotechnische Zeitschrift*, June 30, 1921.

Lamps and Lighting

Evolution in Street Lighting.—ELIHU THOMSON.—A brief history having special reference to the early lighting of streets by electricity, with a description of some of the early generating equipment.—*General Electric Review*, August, 1921.

Generation, Transmission and Distribution

Greatest Possible Span of Overhead Lines.—H. SCHENKEL.—The author investigates mathematically the longest possible span of wires and comes to the conclusion that it is permissible to go to spans of 2,000 m. and even more and yet be within safety limits. Theoretically spans up to about 2,000 m. could be used, employing copper or aluminum cables, but this would give a sag of about 700 m. and would therefore not be practicable. If, however, steel or bronze is chosen for the conductor, a 2,000-m. span will give a sag of only about 150 m., which is perfectly feasible for long river or valley spans. For the exact calculation of very long spans the customary parabolic formula gives too small values. The catenary formula should be used instead. Several actual examples are calculated in full detail.—*Elektrotechnische Zeitschrift*, July 7, 1921.

Switching Stations of One or More Stories.—H. PROBST.—One of the best protections against overvoltages is a station lay-out which gives the greatest possible simplicity of all apparatus installed. It is an established fact that more troubles are caused by faulty switching than by any electrical reason. Many four-story switching houses are in operation which generally have the cable potheads and disconnecting switches on the ground floor, instrument transformers on the second floor, oil switches on the third floor and the buses and their disconnectors on the top floor. The author points out how many steps it requires along the corridors and up and down stairs to locate possible trouble with this apparatus. Long experience seems to indicate that a two-story arrangement, with cable potheads, instrument transformers, oil switches and disconnectors on the first floor and buses with their disconnectors on the upper floor, gives not only the safest operation but is also the cheapest to build. Then the author compares the two-story arrangement with the American out-of-door, or one-story, station, and comes to the conclusion that for present conditions in Germany the two-story, indoor station is cheaper. The reason is quite interesting: Owing to the present great coal shortage porcelain is hard to obtain and very expensive. As a sub-

stitute, bushings made of paper are used extensively, which, however, would not stand outdoor service. Another reason is that buildings and building labor are very cheap. For example, the cost of the building is only 10 to 15 per cent (with and without including the cost of the transformers respectively) of the total cost of a two-story, indoor switching station. It is also mentioned that in American outdoor stations twice as many oil switches and disconnectors are used as in indoor stations. Oftentimes objections are raised against an outdoor arrangement, as it is very undesirable to do outdoor work on the switches during a rain or snow storm. As a remedy remote-controlled oil switches are recommended, which entails again a far higher investment. While there may be cases where an outdoor arrangement might be better, in most instances a two-story housed-in station will be cheaper at present (in Germany).—*Elektrotechnische Zeitschrift* and Allgemeine Elektricitäts Gesellschaft *Mitteilungen*, May and June, 1921.

Alternatives to Coal for Power Production.—PERCY E. RYCROFT.—In summarizing the consideration which should be given to the matter of choosing a fuel substitute, the author sets down the following: (1) The fuel cost of evaporating 1,000 lb. of water; (2) labor costs for the same work (including cost of handling fuel, firing and removal of ash or residue); (3) maintenance costs for evaporating 1,000 lb. of water (including cleaning, renewals and repairs); (4) the capital cost of the plant. For the year ended March 31, 1919, the author gives the following figures to show the method of generation of nearly 5,000,000,000 kw.-hr.:

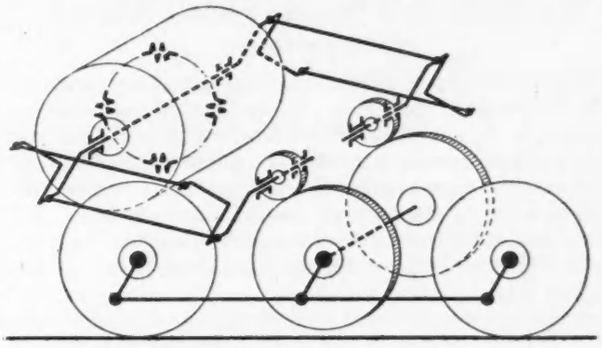
	Kw.-Hr.
By coal and coke	4,623,000,000
By waste heat	68,000,000
By exhaust steam	58,000,000
By refuse	28,000,000
By tar fuel	4,000,000
By gas and suction gas	61,000,000
By oil engines	23,000,000
By water power	11,000,000

The methods of generating electrical energy other than by coal and coke are then discussed in detail.—London *Electrician*, June 24, 1921.

Traction

Possible Developments of Electric Main-Line Locomotives.—E. SEEFEHLNER.—This paper gives the results of a very interesting and exhaustive study of existing and newly suggested methods of mechanical drives between the motor or motors and the drivers of electric locomotives. It is beyond doubt that electric traction on main lines has proved its superiority over steam locomotion, but the details of the driving system proper—involving the respective merits of the direct gearless type, the simple gear drive and the great variety of rod drives—are still in the experimental stage. Each of the drives mentioned has its inherent advantages and shortcomings, and it is very desirable to devise some new drive embodying as many advantages of all the existing types as possible without their disadvantages. The gearless type with motors directly on the shafts is considered by the author as the one least suitable for future developments. Its only desirable feature is the steady and uniform torque. The rod drive with intermediate gear and a jack shaft is held to possess the greatest merit. Using a double 90-deg. crank shaft on either side of the motor and the gear-jack shaft, a very steady pull may be achieved,

No. Shafts	Engine Type	Motor Type	Output
2	B	I	1.0
3	C, 1B	II	1.5
4	D, 1C, 1B1, B + B	2 × I	2.0 = 2 × 1.0
5	E, 1D, 1B1, 1B2	III	2.5
6	F, 1E, 1D1, 2C1 2B2, C+C, 1B+B1	II	3 = 2 × 1.5
7	1D2	IV	3.5
8	D + D, 1C + C1, 2B + B2	4 × I	4 = 4 × 1.0



DOUBLE CRANK-AND-GEAR-MOTOR DRIVE FOR ELECTRIC LOCOMOTIVES

as shown in the accompanying sketch. The following locomotive types are suggested: F, for slow and heavy freight engines for grades; C + C, same for double-unit engines; 1E, for medium-speed passenger engines for grades; 1D1, for heavy express engines for medium grades; 1B + B1, same for double-unit engines; 2C1 and 2B2, high-speed passenger engines for level tracks. For this whole gamut of service four sizes of motors will suffice, as shown in the accompanying table.—*Schweizerische Bauzeitung*, July 9 and 16, 1921.

Electrophysics and Magnetism

Recent Application of Infra-Red Radiations.—M. LARIGALDIE.—In the focus of a gilded parabolic reflector a small set of platinum-tellurium thermocouples is placed, the ends of which lead to a very sensitive galvanometer. Such an arrangement will detect very small and distant centers of heat, or, as in this particular case, any body the temperature of which differs from its surroundings, as, for example, floating icebergs. A reflector of about 10-in. (25.4-cm.) diameter will suffice for a distance of 8 miles (12.8 km.).—*Bulletin de la Société Française des Electriciens*, April, 1921.

Telegraphy, Telephony and Signals

Tests and Experiences with Wireless Rapid Telegraphy.—F. BANNEITZ.—The idea of operating the different well-known and established rapid telegraph systems by wireless is not new, but an impetus has been given to it since the establishment of the new German state wireless network by the desire to increase the economy and capacity of this system. Promising results, however, have been possible only since the use of audion tubes as senders and amplifiers. The author describes a number of experiments made with rapid telegraph systems of the Wheatstone, Siemens-Halske, Baudot, Hughes and pendulum types. Using a 1-kw. audion sender, a distance of 300 km. can be covered safely. It is expected to standardize the wireless Siemens type of rapid telegraph in the German Republic.—*Elektrotechnische Zeitschrift*, July 7, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Germans Fear Muscle Shoals Nitrate Competition

REPRESENTATIVES of the American Farm Bureau Federation appearing before the Senate finance committee to ask that ammonium sulphate be left on the free list charged that the men advocating a duty of $12 a ton on ammonium sulphate to facilitate the development of the by-products of coke represent the same interests that were largely responsible for the defeat of the proposed government operation of the nitrate plant at Muscle Shoals. In the course of the testimony it was asserted that while domestic producers of by-product ammonia are afraid of German air-fixed nitrogen production, the Germans in turn see in the Muscle Shoals plant the greatest possibility of competition.

Senate Committee Hears Objections to Tariff on Mica

GENERAL dissatisfaction with the mica paragraph in the tariff bill as it passed the House has been manifested before the Senate finance committee. The manufacturers and dealers in mica suggest that the paragraph read as follows:

Mica valued at not above 15 cents per pound, 6 cents per pound; valued above 15 cents per pound, 30 per cent ad valorem; mica splittings, 30 per cent ad valorem; mica plates and built-up mica and all manufactures of mica or of which mica is the component material of chief value, 60 per cent ad valorem; ground mica, 25 per cent ad valorem.

The domestic producers of mica would have the bill amended so that the paragraph would read:

Mica—Unmanufactured or rough trimmed only and mica splittings, 25 cents per pound and 50 per cent ad valorem. Cut, stamped, or trimmed, built-up mica, and all manufactures of mica or of which mica is the component material of chief value, 50 cents per pound and 50 per cent ad valorem. Phonograph diaphragms, 10 cents each and 50 per cent ad valorem. Crude, raw, scrap or refuse, 1 cent per pound and 50 per cent ad valorem. Ground, flakes or dust, 2 cents per pound and 50 per cent ad valorem.

C. W. Jefferson, the manager of the Mica Insulator Company of New York, in the course of his testimony before the committee, said:

"Mica board to be of universal use for electrical purposes must be made of mica splittings from mica of low resiliency and extreme softness. It so happens that the mica we obtain from India combines these two features to a greater extent than any mica mined in this country. If mica splittings for making mica board are not in competition with domestic miners—and I maintain they are not—what use can a tariff be except to produce revenue for the government? The lower the price of mica board, the less use of substitutes would be made. Most of these substitutes are in some form or other of wood pulp.

"Then, again, if the cost of mica splittings be lowered so that their use could be extended, the result would be an improvement in the quality of all kinds of American electrical machinery.

"As a general insulation mica stands on a pedestal high up above any other, and it is the rending of sheet mica into films—the films being the foundation of the business—that enables mica to be used economically in the electrical industry. It is our raw material in the same sense as cotton after it is ginned is the raw material in the cotton industry."

Michigan Expects to Have Rural Service Rules

FINANCING of rural extensions by the consumer with maintenance by the utility and a method of charging based on a fixed charge plus an energy charge were favored in the report of the overhead-lines committee of the Michigan Electric Light Association at its recent Ottawa Beach meeting. The committee in connection with utility commission representatives expects to work out a method for handling the service. The methods so far discussed seem to parallel closely those that have found favor in other Middle Western states. Commissioner Potter, in his address before the convention, asserted that it was necessary to find a satisfactory method by which this service could be given profitably to both the consumer and the utility. It is not unlikely that before the work is done the matter of overhead rules and possibly that of inductive interference may have to be considered.

Navy Department Makes Arrangements with Electrical Manufacturers

IN THE opinion of Admiral Robert F. Griffin, head of the Bureau of Engineering of the Navy Department, no cancellations of contracts for electrical equipment for the navy will be made necessary by the reduction in naval appropriations. Satisfactory arrangements already have been made with most of the contractors. As a result of the reduction in appropriations it will be necessary to slow down the construction program. This of necessity will affect the manufacture of electrical equipment, since approximately one-sixth of the cost of a battleship is represented by things electrical.

It was the plan of the Navy Department to spend about $20,000,000 on electrical equipment during the current fiscal year. The reduction in the appropriation, however, has made it necessary to reduce that amount to $10,000,000. The remaining $10,000,000 worth of equipment will be taken, however, but deliveries must be extended for at least six months after the end of the current fiscal year, and it may be that it will be necessary to spread them throughout 1922-23.

Dr. Peter Cooper Hewitt, Noted Inventor, Dies in Paris

CABLE dispatches from Paris announce the death of Dr. Peter Cooper Hewitt on Aug. 25. Death resulted from an attack of pneumonia which set in following an operation for abdominal trouble.

Peter Cooper Hewitt, electrical and mechanical inventor and engineer, bore by inheritance the names of two among the most eminent New Yorkers of a preceding generation. His father was Abram Stevens Hewitt, a leading iron manufacturer and merchant, Representative in Congress, Mayor of New York and promoter of many civic, educational and philanthropic causes. His mother, Sarah Amelia (Cooper) Hewitt, was a daughter of Peter Cooper, inventor, manufacturer, railroad builder and benefactor of New York in the gift of the Cooper Union for the Advancement of Art and Science, more commonly known as Cooper Institute. Peter Cooper Hewitt was born in New York City on March 5, 1861, and was educated at the Stevens Institute of Technology at Hoboken and at the Columbia University School of Mines. In boyhood he manifested a strong inclination toward mechanics, and his courses of study were directed toward the mechanical, chemical and electrical sciences, in which he developed much proficiency. One of his earliest inventions was that of improved machinery in his grandfather's famous glue factory, and this was followed with new forms of centrifugal machines, evaporators and other devices for use in breweries. The early experiments in motor vehicles and flying machines enlisted his interest, and he made a number of inventions relating to them and in later years devoted considerable time to the study of the helicopter. But about 1898 he began to devote serious attention to electrical science and in that field achieved his greatest success.

PETER COOPER HEWITT

In engineering circles Dr. Hewitt was probably best known for his work with the mercury vapor arc. Four fundamental inventions—the vaporized mercury electric lamp, the static converter or rectifier used to convert alternating currents into direct currents, the electrical interrupter and the wireless receiver—were developed by him as the result of years of experimentation with electric currents passing through mercury vapor. He devised a telephone relay and electric wave amplifier as well as apparatus for use in connection with the wireless telephone and telegraph.

Because of his scientific attainments during the world war Dr. Hewitt was made first vice-chairman of the Naval Consulting Board and in that capacity did much valuable patriotic service. He was a director or trustee of the Cooper Hewitt Electric Company, the Hewitt Realty Company, the Hexagon Realty Company, the Lehigh & Oxford Mining Company, the Midvale Water Company, the Madison Square Garden Company, the New York & Greenwood Lake Railroad Company, the Cooper Union and the House of Rest for Consumptives. He was a member of the American Institute of Electrical Engineers, the American Physical Society, the American Geographical Society, the Society of Naval Architects and Marine Engineers, the New York Electrical Society, and the General Society of Mechanics and Tradesmen, and also of the Century Association, the Aero Club of America, the Automobile Club of America, and the Union, Knickerbocker, Manhattan, Engineers', Players', Lambs', Brook, Racquet and Tennis and Tuxedo clubs.

Pinchot Opposed to Acceptance of Ford's Muscle Shoals Offer

HENRY FORD'S offer for the government properties at Muscle Shoals, Ala., still continues to attract attention. One of the latest public men to delve into the proposition is Gifford Pinchot, who after studying Mr. Ford's offer comes out flat-footedly against it. In an open letter issued from his office in the Real Estate Trust Building, in Philadelphia, under date of Aug. 25, Mr. Pinchot said:

The recent offer of Henry Ford to take over government property at Muscle Shoals on the Tennessee River is so important that I take the liberty of laying certain essential facts before you.

The first part of the Ford offer is to lease the Wilson Dam and Dam No. 3 for 100 years, with indefinite renewals, provided the government will complete them and install machinery to produce 850,000 hp. Mr. Ford offers to pay 6 per cent on the $28,000,000 which he estimates will be necessary to complete this work, or 3.4 per cent on $48,000,000, Mr. Ford's own estimate of the whole government investment in dams, locks and power houses. Even if we add all other annual payments (the so-called amortization payments and payments for the repair, maintenance and operation of dams, gates and locks), the total would be equivalent to interest at the rate of only 3.6 per cent. Mr. Ford offers also to give the government 300 hp. for the operation of the locks.

Please note that for the water power itself Mr. Ford would pay nothing and that he would be free from all taxes on the property. Other lessees of water-power rights from the government not only bear the total cost of building their own dams and power houses and pay taxes on them, but they also pay for the water power in addition. The Ford offer is like offering a man 3.6 per cent on the cost of his factory as rent and then asking him to throw in a coal mine to supply fuel for the engines for nothing.

There is no allowance for depreciation, and the government would beyond question have to pay the cost of injury to the dams or locks from floods or other causes. Moreover, there is nothing in the offer to indicate that the government, in order to protect its own property, would not have to bear the expense of replacing enormously costly machinery when it had been worn out in Mr. Ford's service.

The second part of the Ford offer is to buy Nitrate Plant No. 1, which cost the government in round numbers $13,000,000; Nitrate Plant No. 2, which cost the government in round numbers $70,000,000, and other property which brings the total cost to $85,000,000, and to pay $5,000,000 for it all. The property for which this offer is made includes steam machinery to produce 160,000 hp., which alone is worth far more than Mr. Ford's offer for the whole. In addition, the government is to buy from the Alabama Power Company the land upon which certain of the foregoing structures were built and to turn that over to Mr. Ford also.

In return for the lease, for the purchased property and for the water power without charge Mr. Ford offers, in addition to the payment mentioned above, to do three principal things:

First—"To maintain Nitrate Plant No. 2 ready to operate

. . . in time of war for the production of explosives," and in the event of war to turn it over to the government for that purpose.

Second—"To operate Nitrate Plant No. 2 to approximate present capacity in the production of nitrogen and other fertilizer compounds," and in this business to limit his net profits from the manufacture and sale of fertilizer products to 8 per cent.

Third—The offer as writeen suggests producing, but contains no direct proposal to produce, fertilizer for the benefit of American farmers. That could, of course, be corrected in the final contract, for I have no doubt that Mr. Ford desires to make fertilizer at a total net profit of 8 per cent. Nitrate Plant No. 2, however, is not adapted to making fertilizer, but only cyanimide, one of several materials used for the production of fertilizer and not one of the best at that.

The fact is that the Ford offer is not mainly a fertilizer proposition. It is seven parts water power to one part fertilizer, even if the fertilizer part should work out. For, if Nitrate Plant No. 2 were to be permanently employed in the manufacture of fertilizer, it would consume but 100,000 hp. out of the 850,000 hp. installation. This is the heart of the whole matter.

CONTRARY TO ROOSEVELT POLICY

As a water-power proposition the Ford offer is in every important point directly contrary to the Roosevelt water-power policy, which after fifteen years of struggle was finally enacted into law last year. The Roosevelt policy provides that all water-power leases shall be limited to fifty years. The Ford offer asks for 100 years with indefinite renewals. The Roosevelt policy provides for return of the government works at the end of fifty years. The Ford offer provides for indefinite private possession of the government works. The Roosevelt policy provides for regulation of the price to the power consumer. The Ford offer, so far as the United States is concerned, provides no check on what the power consumer must pay. The Roosevelt policy provides that public water power taken for profit shall make a return to the public. The Ford offer asks for many hundred thousand horsepower for nothing.

The amount of power Mr. Ford could develop under his offer is greater by half than all that is now being developed at Niagara Falls. If Mr. Ford were to pay for it at the rates charged by the government to other companies that build their own works, as Mr. Ford would not, it would cost him about $150,000 a year.

Beyond question Nitrate Plant No. 2 ought to be maintained in condition for producing explosives in case of war. Most certainly it ought to be used for making fertilizer for American farmers. The wisdom of developing the water power on the Tennessee and its tributaries is beyond question. But all these things can be done with fairness to the public.

I do not believe that Mr. Ford's offer should be summarily rejected. I do believe that it should be changed, first, to make it fit the Roosevelt water-power conservation policy, now the law of the land; second, to make it pay for the property of the people something approaching what that property is really worth, and, third, to make what it offers to the farmers clear beyond doubt.

It is said that certain Wall Street magnates who hate Mr. Ford are anxious that his offer should be rejected. What these men think about Mr. Ford and his offer is surely no reason for giving him public property of enormous value for a consideration wholly inadequate and on terms utterly unfair to the public.

I should be glad to see Mr. Ford make money, and plenty of money, out of taking over the property of the people as he proposed to do, but not such perpetual and gigantic profits as his offer would assure. It is fair to consider the public also, and to remember that all the annual payments Mr. Ford offers to make would amount to only one-third of the yearly taxation necessary to meet the interest charged (at the Liberty loan rate of 4¼ per cent) on the government's net investment in the property he proposed to take over, and that he would get the water power for nothing.

Morton Resigns as General Manager of National Contractors' Association

FORMAL announcement of the resignation of W. H. Morton, general manager and secretary-treasurer of the National Association of Electrical Contractors and Dealers, has been made by James R. Strong, national chairman, as follows:

It is with regret that I announce to the membership the resignation of W. H. Morton as secretary-treasurer of the national association.

W. H. MORTON

Mr. Morton is leaving us to become secretary and general manager of the Sanborn Electric Company, Indianapolis, and while I feel Mr. Morton's resignation as a personal loss and a serious loss for the association, I sympathize with his desire to re-establish himself in the electrical construction business and wish him every success in his new undertaking.

The national executive committee at its last meeting at Buffalo appointed a sub-committee with power to fill the vacancy in case Mr. Morton's resignation was offered (negotiations were pending at that time), and upon receipt of Mr. Morton's resignation the committee canvassed the subject and received among others an application from Mr. Farquson Johnson, our editor, for the position of secretary-treasurer.

The committee gave the matter careful consideration and after a full discussion voted unanimously to accept Mr. Johnson's application, being fully convinced of his capabilities, great interest in the success of the association and positive wish to carry on the association work along the lines laid down by Mr. Morton.

Mr. Johnson does not lack experience in managerial lines, although his activities have been largely devoted to publishing and printing interests. He was at one time the general manager and superintendent of a large printing establishment in Chicago, employing a hundred or more workmen; for five years he was publicity director and office manager of a prominent publishing company in New York City, afterward becoming sales manager, and during the world war he was employment director of a government explosives plant. Since 1919 Mr. Johnson has been a close associate of Mr. Morton at national headquarters and naturally he has become familiar with the requirements of his new office.

Mr. Johnson will assume his duties on Sept. 1 and on his behalf, I ask your earnest and hearty co-operation.

Ever since the association was founded twenty years ago Mr. Morton has been one of its most active workers. He was the first secretary and has held that office continually since 1901, except during the five-year period 1913-1918, in which he developed his personal interests in Porto Rico. In 1918 he returned as general manager of the association and its official publication. Last year he was made treasurer also. The Sanborn Electric Company, of which Mr. Morton is to become secretary and general manager, is generally recognized as one of the strongest contractor-dealer organizations in the Middle West.

Although his resignation came as a surprise to many of his associates and is a source of regret as far as the association is concerned, friends of Mr. Morton are congratulating him on his new connection.

Harding to Call Conference on Non-Employment

PRESIDENT HARDING has decided to call a national conference in Washington on non-employment. The Department of Commerce in co-operation with the Department of Labor is to formulate the plans, which it is expected will be ready for the President some time during the week. In making the announcement at the beginning of the week Secretary Hoover said:

"The object of the conference will be to inquire into the volume of needed employment, the distribution of non-employment, to make recommendations as to measures that can properly be taken in co-ordinated speeding up of employment by industries and public bodies during the next winter, and in addition a broad study of the economic measures desirable to ameliorate the employment situation and give impulse to the recovery of business and commerce to normal. Many constructive suggestions have been made to the department by employers, the governors of states and city officials.

"While the business situation is steadily improving, yet some sections of the workers may have exhausted their savings by the coming winter, and they must be a matter of extreme solicitude. It is inconceivable that America, with its surpluses in food and clothing, with housing—though crowded—and with an abundance of fuel, could allow any suffering among those of our own people who desire to work. It is necessary that we should be forehanded in the preparation of such measures as will prevent any such suffering."

New Stock Dividend Plan for General Electric

THE General Electric Company has decided to substitute for the present semi-annual stock dividend of 2 per cent an annual dividend of 5 per cent, payable in shares of $10 par value not participating in future stock dividends but entitled to fixed cash dividends of 6 per cent. This is in addition to the regular cash dividend. Because of the delay involved in securing appropriate legal and corporate action the Jan. 15 stock dividend of 2 per cent will be paid in the present stock of the company.

In making this announcement to the stockholders, C. A. Coffin, chairman of the board, said:

"The yearly rate of orders received for the first thirty-three weeks of 1921 is $180,440,000. The orders for 1914 to 1916 were: 1914, $83,748,521; 1915 (excluding $33,980,000 for munitions), $98,385,891; 1916 (excluding $2,416,000 for munitions), $167,169,058. The 1916 orders were more than 50 per cent greater than the orders for any year prior to 1915 in the history of the company. Profits for the year 1921 promise to provide for the cash and stock dividend requirements for the year.

"As far as can be foreseen no financing on the part of your company will be necessary for some years. Your company has in excess of $40,000,000 cash on hand, has large receivables and no current liabilities other than monthly accounts and federal taxes. It has ample manufacturing facilities in the highest condition of mechanical efficiency to take full advantage of such increased demands for its products as may come with a return of business activity. It is appropriate to call your attention to the fact that the company's present surplus and reserves exceed by $20,000,000 the book value of all its manufacturing plants, machinery, equipment and real estate. These facilities represent a cost of $182,271,111 at Dec. 31, 1920, and were carried at a book value of $66,536,682 as of that date."

Earl E. Whitehorne to Investigate Business Problems of Electrical Industry

EARL E. WHITEHORNE, who has been a contributing editor to the ELECTRICAL WORLD for a number of years, will hereafter devote his entire time to the paper as chief commercial editor. The editors and publishers of the ELECTRICAL WORLD see at this time a peculiar need for the ascertainment of fundamental facts and for business leadership to bring about the early recuperation of business in all branches of the electrical industry. In addition to the service the ELECTRICAL WORLD has always furnished in reflecting the trend of events within the industry, special investigations will be conducted to analyze and interpret constructively current opinion on problems of primary importance to electrical manufacturers, jobbers and electric light and power company executives. These investigations Mr. Whitehorne will conduct. He will inject into them that straightforward commercial thinking and individuality which have always characterized his writings.

EARL E. WHITEHORNE

For this work Mr. Whitehorne is particularly fitted. His practical experience has brought him into contact with central-station companies, jobbers, contractors and electrical manufacturers. In addition, as an editorial writer and business counselor for the past thirteen years, he has studied all phases of the problems of market development and better selling.

Mr. Whitehorne was born in 1881 at Verona, N. J. His first position was with the Morton Trust Company, New York City, where he became an accountant in the company's foreign department. This work he gave up to take up selling, and his opportunity came first in the marketing of electric signs. In this connection Mr. Whitehorne interviewed large central-station companies as far West as Denver and as far South as Richmond. He attended the first commercial session of the N. E. L. A. in Denver in 1906, which consisted of one morning session, and since that time he has followed closely the commercial development of that organization.

In 1907 Mr. Whitehorne became interested in an electrical contracting business in Newark, N. J., which he conducted until Percy Ingalls and C. W. Lee, then respectively general agent and advertising manager of the Public Service Corporation of New Jersey, started the C. W. Lee Company to conduct a central-station advertising service. Mr. Whitehorne became associated

with this company and was successful in conducting advertising and good-will campaigns among central-station companies throughout the country, the need of better selling methods in their commercial departments having at that time come to be recognized. In 1907 the C. W. Lee Company, with the assistance of Frank B. Rae and Mr. Whitehorne, started the publication *Selling Electricity*, afterward known as *Electrical Merchandise*. Mr. Whitehorne was associated with that journal continuously in an editorial capacity until it was sold to the McGraw Publishing Company and consolidated with *Electrical Merchandising* in July, 1916. For a few years previous to that date Mr. Whitehorne built up an advertising business and counselor service mainly to manufacturers who sold through central-station companies and to electrical jobbers. Mr. Whitehorne has been a member of many important commercial committees of the N. E. L. A. and for years has acted in an advisory capacity for the Society for Electrical Development. Since 1915 he has served as a contributing editor to the ELECTRICAL WORLD and *Electrical Merchandising*. He will continue this relationship with the latter.

Southern California Is to Have High-Tension Experimental Laboratory

THE Southern California Edison Company has contributed funds for erecting on the campus of the California Institute of Technology a high-tension laboratory where extensive investigations on the transmission of energy at high voltage will be made. These studies will be conducted by the engineering staff of the Southern California Edison Company and by the physics and electrical engineering departments of the Institute under the direction of Dr. R. A. Millikan and Prof. R. W. Sorensen. Dr. Millikan, who is now professor of physics at the University of Chicago and who has gained world-wide distinction for his original researches on the electron and the structure of matter, has just been appointed director of the Norman Bridge laboratory of physics and chairman of the executive council of the California Institute of Technology.

The new high-tension laboratory will represent an investment of about $75,000. Other research work, such as studies of the constitution of matter and its relation to the phenomena of radiation, will be undertaken.

Change in Practice of Holding Institute Meetings

A COMMITTEE of the American Institute of Electrical Engineers is now at work formulating plans for the meetings of the Institute in accordance with the resolutions adopted by the board of directors changing the present practice. So many sections have been formed that it is impossible to give to each one of the regular monthly meetings of the Institute. It has therefore been decided to make these monthly meetings section meetings instead of meetings of the national body. In addition, the board has decided to hold four general meetings of the national body, besides the annual business meeting, one of them to be the annual convention. The detailed recommendations for making these plans operative are expected to be ready for the consideration of the board at its October meeting.

Consolidation of Radio Interests Under Way

THROUGH the acquisition by the Radio Corporation of America of the coastal stations of the International Radio Telegraph Company, considerable progress has been made toward the consolidation of the two companies. The Radio Corporation of America operates under Marconi, General Electric and American Telephone & Telegraph radio patents. When this company was formed a year or so ago there was a pooling of patent interests.

About the same time the Westinghouse Electric & Manufacturing Company acquired control of the International Radio Telegraph Company through subscription to $2,500,000 of its capital stock and by terms of a patent license agreement gained exclusive rights under the group of patents of the International company for the manufacture of apparatus for all purposes and the use thereof for all other purposes than commercial wireless communication for the public. The most important patents thus acquired were the Fessenden and Armstrong patents.

Under the new consolidation, through which the Westinghouse company has acquired a substantial interest in the Radio Corporation of America, it is learned that there will be a pooling of all radio patents. General Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company; L. A. Osborne, president of the Westinghouse Electric International Company; E. J. Nally, president of the Radio Corporation of America; O. D. Young, vice-president of the General Electric Company, and his assistant, J. W. Elwood, sailed for Europe Aug. 23 on the Aquitania. It is understood that Mr. Young's and Mr. Nally's object in making the trip at this time is to complete negotiations in England, France and Germany for establishing radio service between those countries and the United States.

Plans for Greater Participation in N. E. L. A. Technical Committee Work

IN ORDER to permit of maximum participation in committee work by committee members, Chairman N. A. Carle of the Technical Section of the N. E. L. A. has departed somewhat from the procedure in past years by arranging, in addition to the main-group meetings, sub-group and dual-group meetings in different places, for the most part simultaneously with the main-group meetings. The minutes of the East and West meetings are to be consolidated and issued by the committee chairman as the minutes of his committee.

Each committee chairman will designate some one to represent him to handle the main-group meeting and will outline in advance to this representative what he wants done specifically at this meeting for his general committee work.

The group meetings will be held as follows:

SEPTEMBER. — *Main-Group Meetings.* — St. Louis: Electrical apparatus, Sept. 21 and 22; inductive interference, Sept. 19 and 20; meter, Sept. 19 and 20; prime movers, Sept. 22 and 23; safety rules, Sept. 22 and 23; underground systems, Sept. 19 and 20.

Sub-Group Meetings. — St. Louis: Overhead systems, Sept. 21 and 22; hydraulic power, Sept. 21 and 22.

Dual-Group Meetings. — Salt Lake City: Overhead systems, Sept. 28 and 29; hydraulic power, Sept. 28 and 29.

Sub-Group Meetings. — Salt Lake City: Electrical apparatus, Sept. 28 and 29; meter, Sept. 26 and 27; safety rules, Sept. 29 and 30; inductive interference, Sept. 26 and 27; prime movers, Sept. 29 and 30; underground systems, Sept. 26 and 27.

OCTOBER.—*Main-Group Meetings.*—Philadelphia: Prime movers, Oct. 24 and 25.

NOVEMBER. — *Main-Group Meetings.* — Cleveland: Inductive interference, Nov. 14 and 15; meter, Nov. 14 and 15; prime movers, Nov. 17 and 18; safety rules, Nov. 17 and 18; underground systems, Nov. 14 and 15.

Sub-Group Meetings. — Cleveland: Electrical apparatus, Nov. 16 and 17; overhead systems, Nov. 16 and 17; hydraulic power, Nov. 16 and 17.

Dual-Group Meetings.—San Francisco: Electrical apparatus, Nov. 16 and 17; overhead systems, Nov. 16 and 17; hydraulic power, Nov. 16 and 17.

Sub-Group Meetings. — San Francisco: Inductive interference, Nov. 14 and 15; meter, Nov. 14 and 15; prime movers, Nov. 17 and 18; safety rules, Nov. 17 and 18; underground systems, Nov. 14 and 15.

JANUARY.—*Main-Group Meetings.*—New York: Inductive interference, Jan. 23 and 24; meter, Jan. 23 and 24; prime movers, Jan. 26 and 27; safety rules, Jan. 26 and 27; underground systems, Jan. 23 and 24; electrical apparatus, Jan. 25 and 26; overhead systems, Jan. 25 and 26; hydraulic power, Jan. 25 and 26.

FEBRUARY.—*Main-Group Meetings.*—Pittsburgh: Prime movers, Feb. 27 and 28. Springfield, Ill.: Meter, not set.

MARCH. — *Main-Group Meetings.* — New York: Meter, not set.

Alex Dow Tells Reasons for Detroit Edison Success

THE question as to how the Detroit Edison Company has succeeded in maintaining the good will of its public was answered by Alex Dow, the president of the company, at the banquet of the Michigan Electric Light Association, by a citation of the company's three fundamental policies. These three principles are to maintain the fewest possible rules for the consumer and exercise the utmost care to avoid offense in their enforcement, to avoid promises unless it is certain that they can be kept, and to maintain service at all hazards. The making of numerous rules and their enforcement without intelligent efforts to give the customer a thorough understanding of the reasons for them was held to be a prolific source of misunderstanding.

At the Thursday morning session W. W. Potter, a member of the Michigan Public Utilities Commission, told the delegates that a municipal rate franchise is never valuable unless it is unjust. Either the public must receive service at less than cost or the company must receive more than a fair profit to make such a grant valuable. He expressed the opinion that the clock would not be turned back in regulation matters and that home rule would not be re-established.

James V. Oxtoby of the Detroit bar characterized the term franchise as a term lease under which the holder could not afford to do other than make provision to amortize the property used in giving service. In Michigan franchises are limited by a constitutional provision to a maximum of thirty years. He pointed out that too many utilities are proceeding on the theory that term franchises will be made permanent by renewals and as a result are facing serious trouble when the franchises expire.

The committee on safe wiring recommended through its chairman, J. C. Langdell, co-operative work with the inspectors, contractors and others interested. In the discussion that followed, the State Director of Public Safety, Roy C. Vandercook, pledged the assistance and co-operation of the state in the work. W. S. Boyd, secretary of the Western Association of Electrical Inspectors, pledged the co-operation of that organization and spoke against any attempt to draw a new set of rules when the product of many years of work in the form of the National Electrical Code was available.

The officers elected for the coming year are: President, J. K. Swanson, Jackson; first vice-president, E. Holcomb, Alma; second vice-president, S. B. Tuell, Houghton; secretary-treasurer, H. Silvester, Ann Arbor.

August Financing Considerably Below that of July

STOCKS and bonds of electric light and power utilities totaling $20,944,100 and yielding on an average 7.6 per cent were offered the investing public during the month of August. The large decrease which the month's total denotes under that of July in the volume of investments offered is occasioned by a falling off in both the size and number of the single issues. There were only thirteen single issues during August against twenty during July. Only one issue exceeded $3,000,000 in August, while seven exceeded this amount in July. August, 1920, showed a similar drop from the total of the preceding month. There was no appreciable change in the rate of return yielded the investor. The flotations consist entirely of long-term investments, the periods running from five to thirty years.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
West Penn Power Co.	$3,000,000	25-yr.	First mortgage gold bonds, series D	Reimbursement for extensions	7	7.15	98.25
Middle West Utilities Co.	1,500,000	20-yr.	Secured gold notes, series C	Retire outstanding notes, reimbursement	8	8.05	95.25
Utah Light & Traction Co.	1,401,000	12½-yr.	First mortgage collateral gold bonds	Replace matured issue	8	8.05	99.5
Southern California Edison Co.	6,000,000	27-yr.	General and refunding mortgage gold bonds of 1917		6	7.07	88
Great Western Power Co. of California	500,000	30-yr.	First and refunding mortgage sinking-fund gold bonds, series B	Reimburse for capital expenditures	7	7.33	96
Havana Electric Railway, Light & Power Co.	1,500,000	5-yr.	Secured convertible gold notes	Extensions	7	7.75	97
Consolidated Gas, Electric Light & Power Co. of Baltimore	2,500,000	.....	Cumulative preferred stock, series A		8	8	100
Wisconsin Traction, Light, Heat & Power Co.	1,500,000	30-yr.	First mortgage bonds of 1901		7.5	7.80	98
Northwestern Electric Co., Portland, Ore.	1,000,000	.....	Cumulative preferred stock	Extensions and additions	7	7¼	95
Western United Gas & Electric Co.	600,000	10-yr.	Gold notes of 1917		6	8.30	90
Arkansas Light & Power Co.	650,000	10-yr.	Convertible bonds, secured sinking-fund gold notes	Floating debt, extensions	8	8.50	96¼
Danville, Champaign & Decatur Railway & Light Co.	233,100	5-yr.	Bond-secured gold notes		7.5	8	98
Lexington Utilities Co.	560,000	15-yr.	First lien and refunding gold bonds, series B	Extensions and improvements	6	8.05	82.5
Total	$20,944,100						

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Swedish Water-Power Developments.—At the close of 1920, says a Swedish business journal, the aggregate power utilized in water-power stations in that country amounted to about 1,200,000 hp., to which must be added about 260,000 hp. (135,000 hp. for the state and 125,000 hp. for private concerns), for which equipment was in process of installation.

Tulsa, Okla., Announces Electrical Exposition.—The first annual electrical exposition to be held at Tulsa, Okla., is announced for the week beginning Monday, Oct. 17. Fifty thousand square feet will be devoted to the display of "everything appertaining to electricity," and Sol Dan, managing director, says that the show will be the most elaborate affair of its kind ever held.

San Diego to Increase Capacity.—The San Diego (Cal.) Consolidated Gas & Electric Company will, it is announced, build an addition to its station in that city to house a new 15,000-kw. turbo-generator, the business of the company having expanded so rapidly that even with the additional capacity provided by the purchase of the street railway company's generating station last winter the available output is no longer adequate.

Orizaba Hydro-Electric Plant to Be Enlarged.—S. Pearson & Son, Ltd., the British firm of contractors and oil operators, are planning to enlarge their hydro-electric plant near Orizaba, Mexico. It is said that about 50,000 hp. will be added to the plant and that transmission lines will be extended to a number of towns and industrial centers not now reached. At present a string of cotton mills near Orizaba, as well as that city, Puebla and other towns, are supplied with electric lights and power from the plant.

Heat and Electricity.—According to a nameless but "well-known" individual described as a specialist, who has succeeded in breaking into sundry British newspapers, people do not suffer directly from prolonged heat so much as from the "electricity in the air." If any one doubts this, he need only read the following lucid statement to become convinced that electricity is the maleficent agent in the case: "Mercurial, vivacious people have been the most disturbed. There have been many cases of hysteria and dangerous nervous excitement among them. The reason is apparently the magnetic response of the electricity in their bodies to the electrically charged atmosphere."

Electricity in Vorarlberg.—There prevails at present a great activity in electrical undertakings in the little country of Vorarlberg, in Austria, which is said to be at the present time the only country in Europe without unemployed labor. Large electrical power stations are being erected at the lakes of Spuller and Luener. The Luener hydro-electric plant will be a winter power station of great size, and is to furnish electrical energy to the amount of 30,000 hp.

Commission to Look Into San Francisco's Electrical Supply.—Declaring that it does not desire to charge unjust rates for electricity and resenting attacks upon it made by the municipal authorities, the Universal Electric & Gas Company of San Francisco has petitioned the California Railroad Commission for a revision of its scheduled rates. The company buys electricity at wholesale and sells it at retail in San Francisco. It asks that the commission compel the Pacific Gas & Electric Company, the Great Western Power Company and the Sierra & San Francisco Power Company to sell it at wholesale such hydro-electric power as it may need. The Pacific Gas & Electric Company is now furnishing power to the Universal under a contract assumed when it leased the Sierra & San Francisco Power Company. The petition charges that the Pacific company refuses to supply it with more than the amount called for in the contract and that the Great Western Power Company refuses to furnish it with any power.

New York University Orders Automatic Substation.—In order that its students may keep abreast of the new developments in the electrical industry, the New York University will install a 75-kw. synchronous motor-generator set, with automatic switching equipment. This installation, which will be supplied by the Westinghouse Electric & Manufacturing Company, will be arranged so that it can be started or stopped by push-button stations at various points around the building. In addition to its use for exhibition purposes, it will be employed as a source of direct-current energy for the testing buses. The self-starting, two-phase, synchronous motor will be rated at 112 hp., 100 per cent power factor, 60 cycles, 220 volts and 1,200 r.p.m. The generator is to be a 75-kw., 250-volt, direct-current, 1,200-r.p.m., compound-wound, commutating-pole, two-wire machine, type "SK." The apparatus will be arranged so that on excessive overload series resistors will be automatically cut into circuit to reduce the line voltage to approximately 80 per cent of normal. At the same time an alarm bell will be rung. This, it is thought, will afford an opportunity of reducing the load without shutting off the laboratory direct-current energy. In case the warning of the alarm bell is disregarded, the station will shut down in the time interval necessary to operate the grid thermostat.

West Penn Company Helps to House Its Employees.—The West Penn Power Company has awarded a contract for the erection at Springdale, Pa., of ten houses, at a cost of $4,881 each, for the use of operating employees of its new six-million-dollar power plant and their families. The site selected overlooks the plant and is among the best available in that section. It is planned to begin work immediately and an effort will be made to finish the houses before winter. They will have six rooms and bath and will be of hollow-tile and stucco construction.

New Kentucky Hydro-Electric Development.—A site has been chosen for a power plant four miles below Burnside, Ky., on the Cumberland River, to supply electricity to a score or more industrial sections in Pulaski, Whitley, McCreary, Wayne, Russell, Clinton, Cumberland and Rockcastle counties. The power house, which will cost $700,000, will, it is said, be erected by West Virginia and New York capitalists as soon as federal engineers approve the site. They have been surveying and will soon submit their report to the Federal Power Commission at Washington.

Associations and Societies

N. E. L. A., Southeastern Division.—Dates for the convention of this division at Chattanooga, Tenn., have been changed from Oct. 18, 19 and 20 to Oct. 17, 18 and 19.

Electrical Jobbers' Association, Pacific Division.—The semi-annual meeting of this division was scheduled to take place on Aug. 29, 30 and 31 at Paradise Valley in Rainier National Park. Delegates representing from seventy-five to a hundred electrical jobbers were expected.

Coming Meetings of Electrical and Other Technical Societies

N. E. L. A., New England Division — New London, Conn., Sept. 6-9. (For program see issue of Aug. 27, page 436.)

International Association of Municipal Electricians — Colorado Springs, Col., Sept. 6-10.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-10.

N. E. L. A., Middle West Division and Nebraska Section — Omaha, Sept. 14 and 15. (For program see issue of Aug. 27, page 436.)

N. E. L. A., Great Lakes Division, and Indiana Electric Light Association — French Lick Springs, Sept. 21-23. (For program see issue of Aug. 20, page 387.)

Association of Iron and Steel Electrical Engineers — Chicago, Sept. 19-24.

N. E. L. A., Rocky Mountain Division, and Colorado Electric Light, Power and Railway Association — Glenwood Springs, Sept. 19-21.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-23.

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-29. (For program see issue of Aug. 13, page 336.)

American Electrochemical Society — Lake Placid Club, N. Y., Sept. 29-Oct. 1.

American Electric Railway Association — Atlantic City, N. J., Oct. 3-7.

Empire State Gas and Electric Association — Lake Placid, N. Y., Oct. 6 and 7.

N. E. L. A., Southeastern Section — Chattanooga, Tenn., Oct. 17-19.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Utility Companies Must Be Enabled to Keep Pace with Community Growth.—In granting to the Consolidated Gas, Electric Light & Power Company a temporary increase in gas rates, the Maryland Public Service Commission took the opportunity "again to emphasize the importance to the whole community of keeping the company in a sound condition financially, not only that it may continue to render service to its present customers, but that it also may increase its facilities to meet the increasing demands for service. The intensive campaign to promote industrial development of Baltimore and the extensive projects which the Public Improvement Commission and the municipal government now are contemplating for the development of the large territory recently annexed to the city," said the commission, "accentuate the importance of the Consolidated company being in a position to finance the large extensions which it must necessarily make in order to keep pace with the industrial and home-building growth."

Proper Distribution of Costs on Hydro-Electric System.—An order of the Railroad Commission of Wisconsin granting increases in electric rates in what are called the "loop system" communities of the Wisconsin-Minnesota Light & Power Company has been stayed in the courts. In its report to the judicial body before which complaint against the commission's decision was made, the latter body said: "Cost was not the only factor to be considered in fixing the rates either as between classes of service or as between localities. We wish to call attention to one error in method in all of the studies introduced on behalf of the plaintiffs which we consider vital. All of the distributions of cost, except as to purely local costs, which were introduced on behalf of the plaintiffs were made entirely upon an output basis. In a hydro-electric property a very substantial proportion of the total cost to serve is unrelated to the number of kilowatt-hours generated or consumed. The capacity which the generating stations must have to meet the demands of the customers is a much more important factor in determining the total cost than is the number of kilowatt-hours sent out. The most important differences between the viewpoint of plaintiffs and that which the commission took in its opinion are: (1) Whether an advantage should be given to localities situated relatively close to the sources of hydro-electric power; (2) whether rates should be fixed in each locality strictly upon the basis of the power cost plus the local costs in that locality. . . . Within the past few years there has been a very marked change in the characteristics of the electrical supply in Wisconsin attendant upon the development of large transmission systems and sources of hydro-electric supply. As long as the communities were served by their isolated plants, the plants could within certain limits be developed to meet the established market. This was true generally of the plants generating electricity by steam or internal combustion engines. A decidedly different condition was encountered upon the development of the large hydro-electric plants. Except for the addition of certain units of equipment it was not practicable to develop these plants in a piecemeal manner. The greater part of the investment had to be made before any part of the plant could be placed in operation. It was not possible to develop the hydro-electric plants unit by unit to meet the requirements of an existing market. Consequently, in order that the larger hydro-electric developments of the state might be made it was necessary to have a market for all, or at least for very substantial quantities, of the energy to be generated. . . . In fixing the rates we took into consideration the differences in conditions involved in supplying energy in different communities and groups of communities. . . . We do not believe that the commission is bound to base a schedule of rates or the distribution of costs among the schedules for several classes of service solely upon the analysis of the costs."

Increasing Rates on Which Consumers Have Based Uncompleted Operations.—In granting to the California-Oregon Power Company an increase of 5 or 10 per cent over previous schedules, the California Railroad Commission said: "Applicant's rates, when compared with those charged by other utilities in other parts of the state, are found to be relatively low, and applicant can hardly be expected to continue to earn a low rate of return while charging its consumers less than they would be charged for similar service from other utilities. On the other hand, rates which were initially established at the low levels have been made the basis of uncompleted business operations of its consumers and in a period of decreasing prices cannot be too sharply increased. Moreover, approximately 80 per cent of the energy delivered in California is sold to three special irrigation consumers at a remote part of its system and in competition with its own hydro-electric plants. With these limitations in mind, it is plainly apparent that the revenue from consumers served under the rate schedule specified in the application cannot and should not be increased to insure the return on applicant's property which under more favorable conditions and in a more highly developed territory might be considered reasonable."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Missouri Limitation on Security Issues for Reimbursement Unconstitutional.—The Missouri Supreme Court has declared (State ex rel. vs. Public Service Commission) that the statutory limitation placed upon the authority of the Missouri Public Service Commission prohibiting the approval of security issues for reimbursement purposes where the expenditure was made more than five years prior to the filing of the application for approval with the commission is unconstitutional, at least in so far as bona fide issues under mortgages antedating the effective date of the law are concerned, in that it impairs the obligation of contract within the meaning of the Federal Constitution.

Humanitarian Doctrine.—In Albright vs. Joplin Oil Company the Missouri Court of Appeals made this statement of the "humanitarian doctrine" in injury cases: When one is oblivious to danger or, for physical reason or want of time, is apparently not going to get out of danger, and this attitude becomes apparent to one using an instrumentality that will cause injury, and the attitude of the one in danger is apparent for a sufficient length of time for an ordinarily reasonable person, using ordinary vigilance, to discover it, and the user of the instrumentality has the means at hand to avoid the injury by the exercise of ordinary use of the same, it is his duty so to manage the instrumentality as not to cause injury, and a failure so to do constitutes negligence." (229 S. W. 829.)*

Not to Cut Off Current on Primary Wires Raised to Permit Moving House an Act of Negligence.—Where a telephone wireman was killed while assisting to raise various wires that impeded the passage of a house undergoing removal because of contact with a 4,000-volt power line belonging to the city from which current had not been cut off notwithstanding due notification, a verdict for damages was justified, according to the Supreme Court of Nebraska (Graham vs. City of Lincoln). The fact that the employer's negligence concurred with the negligence of the city in causing the injury did not bar the employer's right to subrogation, and it was not erroneous to fail to instruct the jury that the amount of plaintiff's recovery should be diminished by the amount of compensation already paid to plaintiff by the employing company under the terms of the workmen's compensation act. (183 N. W. 569.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

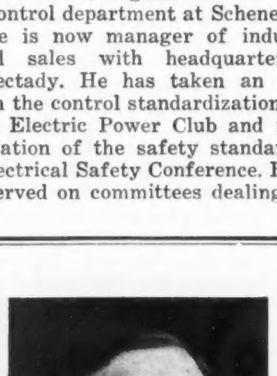
Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

A. H. Sweetnam, who for the last four years has been connected with Stone & Webster, Inc., Boston, in the capacity of electrical engineer, has resigned to accept the position of assistant superintendent of the electrical engineering department, Edison Electric Illuminating Company of Boston. Mr. Sweetnam was born in 1880 in Ligonier, Ind., where he received his early education. After service in the Spanish-American War he was employed in the construction department of the Commonwealth Edison Company and the Detroit Electrical Company, leaving the latter to enter Purdue University, from which he was graduated in the course of electrical engineering in 1905. For two and one-half years he was connected with Sargent & Lundy, designing engineers, resigning to become electrical engineer of the Cosmopolitan Electric Company, Chicago, a position he held until the company was taken over by the Commonwealth Edison Company in 1913. From this time until 1917 he was attached to the engineering department of the Commonwealth Edison Company, having supervision of installation and repairs of Edison, railway and 60-cycle substations. During the last four years he has had charge of the design of electrical installations in power stations and substations and industrial properties, as well as report work, devoting considerable time to properties under the management of Stone & Webster, Inc. Mr. Sweetnam is a member of the A. I. E. E., the National Electric Light Association, the Boston City Engineers and the Woodland Golf Club.

A. H. SWEETNAM

Philip Torchio, chief electrical engineer of the New York Edison Company, is in Europe on a pleasure trip. Much of his time has been spent in Milan, but he has also visited Trieste, Rome and Naples. Recently he has been in Paris. He is expected to return about Sept. 17.

William C. Yates, who has been appointed chairman of the industrial and domestic power committee of the American Institute of Electrical Engineers, is manager of industrial control sales of the General Electric Company. Mr. Yates was graduated from Union College, Schenectady, N. Y., with the class of 1898 and, after serving in the Spanish War, entered the testing department of the General Electric Company, with which company he has specialized in the field of controlling appliances and equipment. He has held successively the positions of engineer of the rheostat department, industrial control specialist at the New York office and commercial engineer of the industrial control department at Schenectady, and he is now manager of industrial control sales with headquarters at Schenectady. He has taken an active part in the control standardization work of the Electric Power Club and in the compilation of the safety standards of the Electrical Safety Conference. He has also served on committees dealing with the standards of the National Fire Protection Association and the American Iron and Steel Electrical Engineers, and last year was a member of the Institute committee of which he is now appointed chairman.



W. C. YATES

E. T. Franklin, general manager of the Trumbull Public Service Company, Warren, Ohio, was elected vice-president of the Ohio Electric Light Association at its recent annual convention. Mr. Franklin has been connected with the central-station industry for nineteen years, having been appointed chief engineer of the Easton Power Company, Easton, Pa., in 1902, a short time after his graduation in electrical engineering from McGill University, Montreal. In 1906 he was advanced to be superintendent of that company, and five years later he was made secretary. The Eastern Pennsylvania Power Company was formed in 1912 by a consolidation of the electrical power companies in and around Easton, and Mr. Franklin was appointed general superintendent of the group. He resigned this position the year following the consolidation to accept the position of plant superintendent of the Empire District Electric Company, Joplin, Mo., and in 1914 organized and directed the results engineering work for the properties of the Cities Service Company in Missouri, Kansas, Oklahoma and Nebraska. Later in the same year he was made general manager of the Trumbull Public Service Company, the position he holds at the present time. During the period of his management the sales of the company have increased from 7,000,000 kw.-hr. in 1914 to 92,000,000 kw.hr. in 1920, and the plant capacity from 2,000 kw. to 40,000 kw.

E. T. FRANKLIN

C. Jerome Abbey, superintendent of the Skowhegan district of the Central Maine Power Company, Augusta, Me., now holds the record of being the oldest central-station man in Maine, having served for thirty-two years at Skowhegan. Mr. Abbey is also a pioneer in transmission-line construction. He worked on the building of a line from Skowhegan to Norridgewock in January, 1899, just prior to the electrical installation made in the Hoosac Tunnel. Twenty-five years of Mr. Abbey's experience was with the Skowhegan Electric Light Company, where he worked his way up from lineman to superin-

tendent. When that company was acquired by the Central Maine Power Company Mr. Abbey was retained in the same position.

Kazutada Sakurai, equipment engineer of the Tokyo (Japan) municipal bureau of electricity, is making a tour of the United States to study electric railways.

Millard C. Ernsberger has been appointed professor of heat-power engineering of Sibley College, Cornell University. He entered Sibley College in 1906 and was graduated with the degree of mechanical engineer in 1908. For a year after his graduation he was instructor in charge of the junior course in power engineering. In 1909 he entered the University of Rochester to act as professor of mechanical engineering.

T. C. Martin has just received from India a version of his "Life of Edison," written a few years ago in association with Frank L. Dyer, of the Edison Laboratory legal and patent staff, and published in two volumes by Harpers. The author of the translation is Rewashanker O. Sompara, of Palitana, India. Mr. Martin confesses to a fair working knowledge of two or three languages, but admits his inability to test the accuracy of this performance, which is in one of the oldest written tongues of Hindustan. At the present moment negotiations are in progress for a translation of the same successful book into Japanese.

J. H. Walker, superintendent of central heating of the Detroit Edison Company, has been elected president of the National District Heating Association. Mr. Walker has been active in .the affairs of the society since 1912, and the handbook on heating engineering soon to be issued by the association is due largely to his efforts. He is a graduate of the University of Michigan,

J. H. WALKER

class of 1911, and became connected with the Detroit Edison Company shortly after finishing college. He was appointed to his present position in 1918. He is a member of the American Society of Heating and Ventilating Engineers and the author of a number of papers presented before this society. He is also a member of the American Society of Mechanical Engineers. In conjunction with the late Prof. John R. Allen he wrote "Heating and Ventilation," a textbook which is widely used in technical schools.

J. F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Company, Oklahoma City, has been elected an honorary member of the Engineering Society of Oklahoma University, and has been presented with a gold emblem by that body in appreciation of his services to the public utility industry in that state. Mr. Owens was born in Illinois in 1878 but received his education in Kansas, where he attended country school, Kansas State Normal College and Kansas State University. He entered the public utility business through the gas field in 1905 at Baldwin, Kan. In 1906 he installed a gas plant at Wagoner, Okla., and managed it for two years. In 1908 he was made general superintendent of the Coney River Gas Company. He joined H. M. Byllesby & Company in 1911 as superintendent of their gas plant at Muskogee, Okla. In 1917 he was made manager of the Muskogee Gas & Electric Company and in 1918 became vice-president and general manager of the Oklahoma Gas & Electric Company as a result of the consolidation of all Byllesby properties in Oklahoma under that name.

J. F. OWENS

Obituary

A. H. Winslow, manager of the appropriations department of the National Lamp Works of the General Electric Company, was killed in an automobile accident near Malinta, Ohio, on Aug. 26. Mr. Winslow was born at Marblehead, Mass., Nov. 17, 1863. He was first associated with the Thompson-Houston Company, which later became the General Electric Company. He was head accountant of the Lynn works, General Electric Company, from August, 1892, until July, 1893, when he was made paymaster, which position he held until April, 1894. At that time he was made disbursement clerk for the General Electric Company, with offices in Schenectady. He served in that capacity until July, 1903, when he was made general auditor of the National Lamp Works, Cleveland. In 1914 he became manager of the newly created appropriations department.

Frank A. Egan, who for many years had been employed by the Adirondack Power & Light Corporation and its predecessors and who had had charge of important construction work for this company, died at Glens Falls, N. Y., recently, at the age of forty-five.

William C. Robinson, vice-president and chief engineer of the Underwriters' Laboratories, died July 31 at the age of fifty-three. He had been associated for thirty years with the work of testing materials by electrical and other means as an aid in fire prevention and had attained a wide reputation in his chosen field.

Louis J. Goldman, president of the Cincinnati Electric Tool Company, one of the largest companies in its line in the Middle West, is dead. Mr. Goldman, who was seventy-one years old, had been in failing health for several months. He had resided in Cincinnati nearly all his life and had long been connected with the electrical industry.

J. M. Smith, sales manager of the Ivanhoe Regent Works, Cleveland, Ohio, died at Utica, N. Y. Aug. 24, while on a business trip. Mr. Smith had been influential for a long time in the development of industrial lighting. While connected with the Buckeye Lamp Company Mr. Smith was able to contribute to the practical side of this development owing the fact that he himself had been a mill man.

Chandler Robbins, formerly president of the Robbins & Myers Company, Springfield, Ohio, died at Baltimore, Md., on Aug. 18 of pulmonary embolism. He was seventy-seven years old. Mr. Robbins was one of the founders of the firm which bears his name and which was originally in the foundry business, and he remained with it until about the time that it took up electrical manufacturing in the late nineties.

Jules Carpentier, one of the founders of the French journal *L'Industrie Electrique*, recently lost his life as the result of a motor-car accident. He was born in Paris in 1851 and educated at the Ecole Polytechnique. His activities were largely devoted to devising arrangements for rapidly and accurately measuring electrical quantities, and he was closely concerned in the production of the instruments for the measurement of electric currents made at the Ruhmkorff workshops. He was, it is said, an important factor in much of the work associated with the names of D'Arsonval, Marcel Duprez and Baudot. Mr. Carpentier was a member of the French Academy of Sciences and a commander of the Legion of Honor.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Lower Prices on Some Poles and Cross-Arms

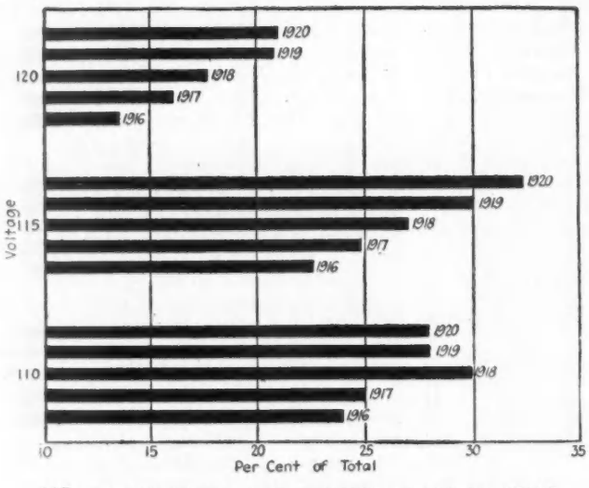
REDUCTIONS are reported this week in certain poles and cross-arms. Chicago, St. Louis and New York territories report that Northern white-cedar poles in lengths from 25 ft. with 4-in. top to 35 ft. with 7-in. top were reduced about Aug. 19 in varying amounts from 15 to 25 per cent, depending on size, grade and classification. Utilities around St. Louis showed a tendency to hold off buying until the fall lighting demands made it necessary, and the reduced prices are stimulating pole sales. Present inquiries indicate a rather healthy business for the next few months. Stocks are in good shape.

Around Chicago the demand has been slow and uneven, and pole movement has not reacted as yet to the price cut. Buying around New York, too, is rather quiet.

Yellow-pine cross-arms have come down about 10 per cent in the past ten days. No change has been reported in fir arms. Railroads and utilities in the Southwest are providing a fairly good call for yellow-pine arms.

Lamp Voltage Tending Strongly Toward 115 Volts

WHILE from the report of the lamp committee presented before the N. E. L. A., in Chicago early last June it was shown that in the distribution of lamps by voltages during the last eight years the voltages of 110, 115 and 120 predominated, it is evident that if there is any one voltage toward which there appears to be standardization it is 115 volts. In 1920 the distribution at these three voltages totaled 81.2 per cent of all large lamps, of which the 115-volt class took 32.3 per cent of the total,



115-VOLT DISTRIBUTION HAS GROWN IN STEADY LEAPS

or 39.8 per cent of these three classes. In 1919 the 115-volt lamps took 38.1 per cent of the total of these three classes, and in 1918 36.2 per cent.

The distribution of the 115-volt lamp has grown fast and virtually in a straight line since 1913. The 110-volt lamp since that date has varied within rather narrow limits, the last two years being even and below 1918. The 120-volt lamp has grown in the last eight years, but 1920 showed little increase over 1919. The 112-volt size has fallen off fast till in 1920 it represented only 5 per cent of the total distribution. All the other odd voltages are below the 5 per cent value and are keeping low except the 125-volt size, which has been holding around 5 and 6 per cent in the last three years.

Of course, the assistance of the lighting companies has been invaluable in reducing the number of lighting voltages, but there is still much to be accomplished in the adoption of lamps of standard voltage within narrower limits.

The lamp committee sent out a questionnaire to its member companies and received answers from 520 companies, or 46 per cent. Of these 498 used one or more standard voltages. Of the thirty-two which used odd-voltage lamps fifteen have reported their decision to standardize and eleven are considering the matter.

During the year 1920, of the companies reporting to the questionnaire, 26.2 per cent raised their voltage, 15.6 per cent lowered it, and 58.2 per cent made no change in voltage. On Jan. 1, 1920, 79.2 per cent of these were completely standardized, while on Jan. 1, 1921, 96 per cent were completely standardized. The committee believes the information obtained from the replies is fairly representative of the practice of the central stations in the United States, inasmuch as the practice of member companies throughout all sections of the country is represented in the result. Consequently it is expected the committee's report next year will show even better results than this year.

Some Factors Affecting Fan Motor Prices

A CONSIDERATION of the costs of fan motors naturally involves costs of the component parts. Manufacturers are at this time studying costs of next year's fans. That electric fans can be produced starting this summer for next season's demand at a cost lower than that encountered for the past season's fans should go without saying. Raw materials, however, must be purchased for the most part this summer if they have not already been purchased. Production undoubtedly is well under way in most plants.

For comparative purposes prices have been taken as of Jan. 1, 1921, and Sept. 1, 1921. No. 2 foundry pig iron, Pittsburgh, is quoted now at $21.96 per ton, as against $34.96 on Jan. 1, a drop of 37 per cent. Black steel sheets, Pittsburgh base, have dropped from 4.35 cents per pound to 2.75 cents, 37 per cent. Since May, 1920, electrical sheets have dropped between 40 and 50 per cent.

Magnet wire prices follow bare copper wire prices quite closely. Bare copper wire at the mill, net, is now 13.25 to 13.50 cents per pound as against 16.25 cents last January, a drop of 18 per cent. Both high and low sheet brass are 18 per cent lower in price now than on Jan. 1.

Insulation prices have dropped in varying amounts. Representative quotations show vulcanized fiber and fishpaper off about 10 per cent, 10-mil varnished cambric off 30 per cent, 5-mil off 5 per cent and 5-mil varnished silk off 22 per cent. A good high grade of shellac is 44 per cent lower than on Jan. 1, while insulating varnishes are reported to have changed little. No change is recorded on mica plate for commutator segments of small motors, although it is 26 per cent lower for large motor use. Cotton tape is 46 per cent off and friction tape in 1,000-lb. lots is 22 per cent lower.

No consideration has been given to separate labor charges in this discussion, but in general the labor charge is less now than it was on Jan. 1.

Wire Makers to Consider Monthly Publication of Statistics

MANUFACTURERS of insulated wire are to meet on Sept. 13 in New York City, at which gathering W. M. Steuart will be present as the representative of Secretary Herbert Hoover. These manufacturers will be represented by four groups—bare wire, rubber covered wire, weatherproof wire and magnet wire—and they have been brought together with a view to discussing with Mr. Steuart the best methods to adopt for obtaining from each group monthly reports on production, current stocks and distribution of their respective industries. These reports may be published monthly by the Department of Commerce, the same as is now being done under twenty headings for other industries in the monthly *Survey of Current Business*, of which Mr. Steuart is director.

New Bill Would Repeal Tax on Electric Fans

AS FAR as can be determined at this writing, the revised tax bill which was introduced into the House of Representatives on Aug. 15 and passed by that body on Aug. 20 contains no provision for an excise tax on electric fans. The federal tax laws which became effective Feb. 25, 1919, imposed a tax of 5 per cent on portable electric fans, this tax being paid by the manufacturer, producer or importer of these fans. Apparently this tax is to be repealed if this bill is made law. It is expected that this bill will be taken up by the Senate at the end of its recess, on Sept. 21, but meanwhile it is said to be in the hands of the Senate committee on finance, which committee undoubtedly will hold public hearings with a view toward possible changes in the bill.

The 5 per cent tax on automobile, automobile truck and motorcycle accessories, under which electrical accessories such as batteries, magnetos, etc., are included, is retained when these accessories are sold to other than the manufacturers or producers of these automobiles, etc.

Portable lighting fixtures, including lamps of all kinds and lamp shades if sold for more than $10, will carry a tax of 5 per cent in the new bill as at present drafted. The old law, after May 1, 1919, carried a tax of 10 per cent on this equipment on the amount in excess of $25 each.

July Electrical Exports Amount to $6,417,336

FOR the month of July the total value of electrical exports came to $6,417,336, the lowest month registered to date this year and the lowest since January, 1920. It is less than half the value of exports of last February, but only slightly below the figure of last July. The figures, however, do not present a like condition when volume of exports is considered and when factory production is considered; because of the decrease in price of electrical goods since last fall. During the winter the factories were able to concentrate on back orders for exports, because of slackened domestic demand, and extra large amounts of goods went through and were shipped during those months, giving the returns large values.

July's figures are almost $900,000 below those of June, or 12 per cent. Still, during July a record for the year to date was established in dynamos and generators and more transformers were shipped from the country than in March, April, May and June. June figures were bettered in switches and accessories and in telegraph equipment. In almost every other line, though, low records for the seven months were hung up.

Considering total exports for the first seven months of this year, these amount to $70,236,330, $17,000,000, or 32 per cent, ahead of the figures for last year in the same period. This fact, it would seem, gives some hope for the industry. The figure for the entire year indicated at this time is more than $120,000,000, 20 per cent over 1920's actual figure.

The figures presented in the attached table were received from the Bureau of Foreign and Domestic Commerce, Washington.

	July		Seven Months Ended—July	
	1920	1921	1920	1921
Batteries	$497,657	$183,525	$3,832,467	$2,810,523
Carbons	119,309	29,317	791,688	277,794
Dynamos and generators	536,400	790,634	3,534,164	4,508,119
Fans	87,892	37,566	805,590	1,129,703
Heating and cooking apparatus	124,485	54,262	1,046,060	1,253,816
Insulated wire and cable	558,791	496,928	4,242,444	7,046,022
Interior wiring supplies	336,881	79,327	1,851,701	1,433,016
Arc lamps	2,004	.....	15,613	8,514
Carbon-filament lamps	5,303	10,802	63,766	104,897
Metal-filament lamps	244,010	153,689	2,298,822	2,652,230
Magnetos, spark plugs, etc.	304,702	85,173	2,224,144	992,079
Meters and measuring instruments	202,612	214,660	1,525,273	2,039,690
Motors	709,086	1,121,583	6,822,986	11,975,300
Rheostats and controllers	26,283	61,755	397,477	776,868
Switches and accessories	299,615	280,258	2,482,289	3,325,800
Telegraph apparatus	33,150	39,107	411,438	793,913
Telephones	215,384	273,533	2,130,025	3,479,206
Transformers	165,728	788,719	2,050,456	5,830,651
All others	2,018,754	1,716,498	16,685,796	19,763,189
Total	$6,488,046	$6,417,336	$53,212,172	$70,236,330

Loom Prices Back to Pre-War Levels

DURING the last week manufacturers of non-metallic flexible conduit reduced prices another five points, or about 14 per cent, bringing the discount up to 70 per cent. This figure is a very fair pre-war price for loom, especially when it is considered that the lowest discount the material has taken at any time is 75 per cent and that was only under the most extreme pressure. Although buying is only on a moderate scale, still reports from certain quarters show that there has come an upward turn to the market, and orders are coming in in a little better volume since this reduction.

Metal Market Situation

THE copper market presents a firmer tone and a firming in price of ⅛ of a cent is noted. Electrolytic in producers' hands is being held at from 12 cents a pound to 12⅛ cents, delivered, for spot copper, with a tendency on the part of all to hold to the 12-cent figure. October is worth one-eighth more. There have been moderate sales by producers for domestic use during the past week, and the outside market seems to have fared equally well.

For export shipment electrolytic is quoted at 11.75 cents, f.a.s., for September and 11.87½ for October. London standard spot copper has strengthened £1 12s. 6d. since last week and presents a much firmer tone following the upset there a fortnight ago.

Galvanizers are in the market again for zinc, but the quantities moving, while larger than a few weeks ago, are still small in volume. The price is slightly easier under close competition in the selling market.

NEW YORK METAL MARKET PRICES

	Aug. 23, 1921	Aug. 30, 1921
Copper	£ s d	£ s d
London, standard spot	66 0 0	67 12 6
	Cents per Pound	Cents per Pound
Prime Lake	12.25	12.25
Electrolytic	12.00	12.00
Casting	11.37½	11.50
Wire base	13.50—14.00	13.25—13.50
Lead, trust price	4.40	4.40
Antimony	4.50	4.50
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Zinc, spot	4.65	4.62½
Tin	26.12½	26.87½
Aluminum, 98 to 99 per cent.	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50— 9.75	9.50—10.00
Brass, heavy	4.50— 4.75	4.50— 4.75
Brass, light	3.75— 4.00	3.75— 4.00
Lead, heavy	3.25— 3.37½	3.25— 3.37½
Zinc, old scrap	2.00— 2.25	2.00— 2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE electrical market as a whole this week shows little improvement over last week, but, to say the least, is holding its own. New York is on an even rate of buying. The Chicago market is spotty, although building permits issued in the month of July were 100 per cent above those in June. Still, there is a heavy increase in inquiries for farm-line distribution apparatus. In Boston there is little change in the situation, but building operations are improving. The Southeastern States find that the expectation for a profitable cotton crop is lending a firmer tone to the market. St. Louis territory reports a better tone to the jobbing market. Energy sales for June were better than those of the same month last year, and the market for pole-line materials is better.

In the Intermountain and Western States crop, stock-raising, lumber and kindred industries are in a satisfactory state, and the San Francisco building strike finally has been settled, with a lower rate of pay.

Price reductions are announced in loom, Western white cedar poles, yellow-pine cross-arms, link belt, pulleys and pole-climbing equipment.

NEW YORK

Little if any change in conditions was reported by the jobbers this week, although the general sentiment is that the low point is well past and a slow and steady improvement is under way. The demand for conduit, wire and schedule material continues on an even keel, orders for the most part being for small and moderate-size quantities, indicating that most work is being done in residences and small business buildings. There has been some demand for material for repair and maintenance work, and at least one jobber reports activity in industrial lighting fixtures.

Prices on standard material remain about the same. However, one manufacturer of pole-climbing equipment has announced a general reduction in prices, effective Sept. 1, and another manufacturer of power-transmitting appliances has announced a lower price schedule, giving as the reason lower manufacturing costs for labor and material.

Heating appliances in general are moving sluggishly and fall buying has not yet appeared. Flatirons only are moving, and the steady demand of the past month has resulted in a temporary shortage. For the larger higher-priced appliances there is little demand.

Collections remain slow, although there is no great uneasiness regarding outstanding accounts. Electrical credit men are, however, extending new credit with a great deal of caution.

Conduit.—Prices quoted for conduit this week remain at the same levels as last reported. The following prices were quoted. For ½-in. black, in 2,500-ft. lots, $54 to $55; ¾-in. $73 to $76, and 1-in., $106 to $108. Galvanized pipe in the same sizes was quoted as follows: $60 to $63.58, $80 to $82.57, and $116.96 to $118.65. Demand continues light but fairly steady and small to moderate-size orders are the rule. Stocks are fair to good in all sizes.

Flexible Armored Conductor.—Demand for this material has not increased but continues steadily for use in wiring new homes. No. 14, two-wire, single-strip was quoted this week at $45 to $47 per 1,000 ft. in 1,000-ft. lots. Stocks are good and some price competition has appeared.

Rubber-Covered Wire.—Stocks are good and demand is on a par with other materials mentioned. Sales are usually in small lots. No. 14 rubber-covered in lots of 5,000 ft. was quoted at $6.25 to $6.85 per 1,000 ft.

Sockets.—Demand is fair and stocks are good to large. Discounts of 25 and 26 per cent in standard package lots have been quoted this week.

Tape.—Prices remain about the same as last quoted. Ordinary friction tape in 100-pound lots is quoted at 35 cents per pound, and rubber tape in the same quantity is quoted at 38 cents.

Heating Appliances.—There has been a steady demand for electric irons, and some jobbers have reported difficulty in obtaining sufficient quantity to fill customers' orders. Other heating appliances are moving very slowly.

Washing Machines—Vacuum Cleaners.—There has been no increase in the sale of washing machines since the 10-per cent reduction went into effect in July. Vacuum cleaners are also proving slow movers. The higher prices of these appliances appear to defer sales at this time.

Pole-Climbing Equipment.—Mathias Klein & Sons, Chicago, have made a general reduction in their line of pole-climbing equipment and tools, effective Sept. 1. On one or two lines there has been a price revision upward.

CHICAGO

A spotty market has prevailed during the past week with a bright spot here and there, but in the main the quietness of the last three months still continues. Jobbers report an unusually heavy influx of inquiries for farm-line distribution apparatus, but so far the orders have failed to come in in proportionate numbers. Prices on most lines have been unchanged, although it is reported that large buyers are able to obtain some concessions. Manufacturing is at a low ebb with little indication of betterment for some time. Makers of electrical automotive equipment increased their July production about 2 per cent over June. They are still far below normal. Retail business has been extremely quiet for several weeks, the fan season being almost entirely over and other lines waiting for the fall buying season.

Building permits for July were 100 per cent ahead of those for June and approximately the same percentage ahead of the monthly average during the period from 1914 to 1919. It must be taken into consideration, however, that a great deal of this building will not go ahead until some decision is reached on the wage scale tangle, and for that reason operations may not actually begin until next spring. Activities in the steel industry in Chicago continue to be sporadic but are better than a month ago. Steam-coal production is still subnormal, with sales negligible, indicating that central-station companies in the Midwest are not purchasing despite predictions of a possible famine.

Wire.—The market has weakened again and bare copper wire may be obtained as low as 14 cents per pound with very few buyers in evidence. The improvement in sales of rubber-covered wire reported last week has not lasted and a new low quotation of $6.15 per 1,000 ft. of No. 14 has been recorded in several transactions. Weatherproof prices are nominally the same as last week, with little demand.

Motors.—No change is discernible in conditions in this line. A few orders for small sizes for shop work continue to come in but make hardly any impression on the large stocks carried by all distributers. There are no price changes.

Dry Cells.—This item is moving in normal quantities. Prices average from 30 to 32 cents. Stocks are good but are not quite so topheavy as they were earlier in the spring.

Porcelain.—Prices are unsettled and movement is slow locally, though sales in the smaller towns in Illinois are improving. The charge for packing has been reduced to 90 cents per barrel.

High-Tension Equipment. — Manufacturers report increased sales of outdoor substation equipment for use in supplying coal mines and manufacturing plants.

BOSTON

Little change in trade is evident this week although factors tending to improve business are plainly at work. Prices weakened last week on non-metallic flexible conduit, and on orders of 2,500 ft. or over sharp competition is evident in flexible armored conductor. Stocks are slowly being liquidated. Inquiries maintain a healthy tone and collections continue to reflect better banking conditions. Building operations are slowly reviving. In the textile and leather fields previous improvement in conditions seems to be well sustained. Appliance trade is dull, featured by substantial reductions in washing-machine prices. With the close of the vacation season a distinct improvement in trade is anticipated. The deflation of labor continues here and there.

Wire.—The demand is very quiet this week, with excellent stocks in hand. In 5,000-ft. lots No. 14 rubber-covered sells around $6.25 per 1,000 ft. Central-station construction is still on a cautious scale.

Flexible Armored Conductor.—Moderate sales are noted, with close competition. No. 14 sells nominally at $51 per 1,000 ft. in 2,500-ft. lots, prices running as low as $44.50 per 1,000 ft. on large orders. Prices are open above 2,500 ft.

Rigid Conduit.—Fair sales are reported, with good stocks. No new price movements appeared during the week. Representative quotations are: 1-in. black, $107.35 per 1,000 ft.; galvanized, $117.55; black, ½-in., $57.92, galvanized, $63.03, all in less than 2,500-lb. lots. Fittings are moving rather slowly.

Fans.—Revived warm weather Monday facilitated renewed movement of fans out of retail stocks, but the season is virtually over so far as the jobber is concerned.

Meters.—Demand is very spotty, varying considerably from day to day. No difficulty in meeting current requirements is heard of, and if building operations quicken this fall, local stocks will be depleted enough to arouse interest in manufacturing propositions.

Air Heaters.—Advance sales for fall business have begun on a moderate scale. The continued high price of domestic fuel bids fair to insure a healthy demand for these equipments before New Year's.

Motors.—Small-order business is all that is reported, but inquiries are fairly active and considerable rehabilitation work in industrial plants is in the air. Sales efforts are largely concentrated on betterment aspects of motor application.

Non-Metallic Flexible Conduit.—Prices were easier at the close of last week, with moderate demand and satisfactory stocks in relation to delivery requirements. The following net prices have been established: ⅜-in., coil to 1,000 ft., $23; 1,000 ft. to 5,000 ft., $20; 5,000 ft. or over, $18.50. For ½-in. lots, coil to 1,000 ft., $27; 1,000 ft. to 5,000 ft., $22.50; 5,000 ft. or over, $21.

Washing Machines.—Prices are lower on a number of representative makes. A leading dealer quotes $110 retail price on new machines of a well-known make, which he features as the pre-war figure. Jobbers are working energetically to get the fall trade into shape, and sales reflect increased interest on the part of the public.

ATLANTA

The fears expressed in some quarters that this fall would again witness low-priced cotton have been largely dissipated by preliminary information that the government's estimate would show a crop of only 7,000,000 bales, a shrinkage of approximately 1,000,000 bales since the last estimate. If this estimate is correct, as all things indicate it is, not only will this year's cotton bring a profitable price but cotton held over from last year will be marketed at an enhanced figure. This outlook is lending a much firmer tone to business in general, and it can be conservatively said that a much better feeling is in evidence all over the territory. Of course, the midsummer dullness is still to be noted, but on every hand are signs of fall activities. Large contractors and builders report increasing interest in construction on the part of industrial plants, while electrical jobbers report the receipt of heavy orders from central-station companies for construction material. The bulk of the jobbers' business, however, is still going to the small contractors engaged in wiring homes, apartment houses and small stores.

Collections have not yet assumed a favorable aspect, though they are somewhat improved over the period of three weeks ago.

Bell-Ringing Transformers.—Activity in this line has been well sustained throughout the spring and summer, owing to the residential boom now under way. Outlying sections are coming into the market, jobbers reporting very satisfactory business. Prices remain firm and stocks are in good shape.

Automotive Cables.—Inquiries of jobbers have increased materially during the past week and an increase of actual sales has been reported, especially on the reinforced, single and twin, No. 14 type armored conductor. Ignition cable shows a more healthy condition as confidence in the future accessory business is increased.

Non-Metallic Flexible Conduit.—A price reduction of 15 per cent in this line was effective last week and has served to check rather than stimulate sales, which up to the time of the reduction have been fairly good. Jobbers' stocks have become somewhat spotty, though shipments are reported very good.

Conduit.—An unusual situation is in evidence in this market, a number of manufacturers taking orders for pipe at prices offered by the buyers. One of the larger jobbers, however, reports a fairly satisfactory volume of sales at standard market quotations. Stocks of both black and galvanized are in fair shape.

Safety Switches.—Interest in this line continues, stimulated by the adoption of rules requiring their installation. The 30-amp., three-pole type is the most popular, although there is a fair movement of all other sizes. Stocks are fair to spotty, with factory shipments good.

Poles.—The last few weeks have produced a brisk demand for all varieties of poles, the number of orders now being about equally divided between chestnut, cedar and creosoted pine. Stocks and shipments are quite satisfactory.

Pole-Line Hardware.—Heavy orders were placed by the larger central stations during the last ten days, the equipment being for both standard and N. E. L. A. types. Stocks are in good shape throughout the territory.

Pins and Insulators.—Unlike pole-line hardware, these lines are very dull, the movement of insulators being particularly slow. No price reductions have been made recently and stocks are in good condition.

ST. LOUIS

A slightly better tone to business is reported by jobbers this week. Some are inclined to believe that gradual betterment may now be expected, others that the week marks but one of the small peaks of the fluctuating curve of demand for electrical goods. However, it seems apparent that the usual fall improvement in certain lines will be experienced this year, but perhaps to a modified extent. Lamp orders show a tendency to increase, there is improved demand for pole-line materials for small extensions and dealers are placing orders for portable lamps. Some report slight improvement in purchases by the railroads. Inquiries from industrial concerns, while not yet developing into appreciable orders, are indicative of possible improvement in the sale of motors, rubber-covered wire, safety switches and the like. The sales of central-station energy in St. Louis continues to exceed each month the sales for the corresponding month of last year.

One jobber reports considerable activity in the sale of repair parts, especially of motors, explaining that industrial concerns are making their old equipment last longer than would ordinarily be the practice. The shoe manufacturers continue to buy considerable quantities of new equipment. All purchases, however, of whatever nature, are for small amounts.

Pole-Line Hardware.—Improved business is reported, orders still being for small amounts and to meet only immediate requirements.

Lamps.—Demand is reported normal for this time of year and normal demand is expected throughout the coming winter. Jobber stocks are inclining toward heaviness. Dealer stocks are in fairly good shape. A continued demand for automobile lamps is reported, and demand for low-voltage lamps for farm lighting is said to be increasing.

Loom.—A 10 per cent reduction has been made but movement is fairly slow. Stocks are in satisfactory shape.

Safety Switches.—Though the turnover continues to be fairly small, there is some improvement in the demand.

Porcelain.—A slight flurry in the prices for porcelain occurred during the week, but the resultant price is unchanged. No material change in the demand can be found.

Rectifiers and Motor-Generators.—One jobber reports that there is little call for motion-picture rectifiers but that a fairly good business is being secured in motor-generator equipment, principally in the smaller Illinois towns. In some sizes shipment from factory stocks can be given, and not more than thirty-day shipments are asked in any others. Battery-charging rectifiers are experiencing a reasonably good demand and delivery from St. Louis stock is available.

Wire.—Slightly easier prices prevail in rubber-covered, No. 14 being priced at $6.10 per 1,000 ft. in 10,000-ft. lots, a reduction of about 30 cents from last week. Weatherproof and bare wire vary in base price from 14½ cents to 15¾ cents per pound. Improvement in sales of rubber-covered are reported, and there are increasing inquiries for it in industrial sizes.

Metal Reflectors.—The demand for reflectors for industrial plants is exceedingly light. Prices are about 10 per cent lower. Stocks apparently are in about normal condition.

Lightning Arresters, Choke Coils and Disconnecting Switches. — Improved buying from the Southern States, especially Tennessee, is reported. Increased attention is being given throughout the entire territory to the advantages of better lightning protection.

SAN FRANCISCO

After sixteen weeks of curtailed building activity, the builders' strike has now been unofficially declared ended. By a vote of approximately four to one the men voted to return to work as individuals on the best terms obtainable, although previously by a vote of two to one they had declined to return as unions. These terms are reported to be at a rate of pay 7½ per cent lower than the previous rate of $10 per day. Various building jobs are now being besieged by ex-strikers, although it is probable that one or two weeks will elapse before things are again running smoothly. The completion of the Western Pacific extension from Niles to San Jose will tap a rich fruit district. Under competitive conditions the canneries are now working at top speed and good prices have been obtained by the growers.

Radiators.—Large stationary sizes are being featured in the present campaign on heavy-duty devices instituted by the Great Western Power Company, and it was reported that a gratifying number of installations both in remodeled and new apartment houses have been arranged.

High-Tension Insulators.—A 10 per cent reduction on the smaller sizes of Thomas porcelain insulators is announced. Present business on the higher-voltage insulators in holding up well despite the fact that the larger jobs have all been allotted and in many cases installed. Still, because of the completion of smaller distributing systems and isolated orders from smaller companies fairly consistent demand is reported.

Lamps.—This is the quiet lamp season, although business has been surprisingly good right up to the end of June. An intensive campaign on Christmas tree outfits has resulted in the virtual completion of dealers' stock arrangements for the coming season.

Wire.—New prices on wire and cord provide that the maximum discount shall be given on coil lots instead of on 2,500-ft. lots as formerly. The new price on cotton-covered twisted in coils runs about $14.50 per 1,000 ft., and it is about $27 per 1,000 ft. on silk twisted, a decrease of about 25 per cent from the previous standard.

SEATTLE—PORTLAND—SPOKANE

An electrical jobber who returned recently from a business trip covering most of western Washington reports conditions considerably improved throughout this section, and it is now anticipated that the coming fall months will see business well on the road to normal conditions. All major crops are excellent and they are finding a ready market. As the farmers are beginning to market their produce money is becoming somewhat easier. Additional lumber mills have opened up during the past week and others are planning to resume operations about Sept. 1. In line with the above, jobbers report more inquiries pointing at new business during the past week than during several weeks previous. Power companies are taking advantage of the low price of copper and are buying heavily to fill their copper requirements. Building is holding up well. Gradual price adjustments downward amounting to from 5 to 10 per cent are still taking place on electrical supplies in general. Household appliances of all kinds are moving normally.

The Portland reports both by manufacturers and by jobbers for the past week are that business is somewhat improved, and some are very positive in regard to the improvement. Stocks are in fairly well balanced shape in most cases, but some overstock in motors and air heaters is noted. Slight reductions during the past week of 8 to 10 per cent have been made in certain lines of wiring devices, tape, solder, loom and general house wiring materials. Some jobbers report collections improved, while others say they are unchanged. This probably comes from the fact that new accounts and current accounts are being taken care of in better shape than formerly while old standing accounts are being paid off as funds become available.

General retail stores report activity in buying from customers in the agricultural section, which indicates a general improvement resulting from the movement of fall crops.

A much better feeling is apparent among the Spokane jobbers. They are optimistic over the prospects for a good fall business, particularly in the appliance line. One company is looking for an especially good washing-machine business following a cut in price to be announced shortly. Orders are coming in more freely and collections are somewhat easier. Deliveries continue to be prompt, with stocks in good condition but light to correspond with the demand that has heretofore existed. The general sentiment seems to be that the worst is over, and that business here should continue to show steady improvement.

SALT LAKE CITY—DENVER

As a purchasing unit the copper mines have been reduced virtually to the point of zero. Thousands of employees have been laid off and salaries and overhead reduced in every possible way. No industry has been harder hit in an indirect way by the shutdown of the copper plants than the electrical. Formerly they bought electrical equipment in large consignments and were among the best customers of the distributing jobbers. Now they purchase only enough to keep the plants in a state of repair pending resumed operations. Salt Lake City has been the meeting place of a convention of the American National Live Stock Association, which spent two days considering ways and means to put the live-stock industry on a better basis. If its recommendations to Congress are carried out in the way of stabilized and systematized freight rates, much good will come to the Intermountain West.

Fans.—The fan season may be said to be at an end in this part of the country. The sales this summer have not been up to the average mark, and jobbers still have excessive stocks in most sizes. Dealers are pretty well cleaned out as they have only purchased to meet their needs from week to week.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Link-Belt Finds Orders Increasing in Size

Another factor indicating the gradual improvement in industrial activity is shown in the increase in orders received by the Link-Belt Company, New York, during the last month. While the orders have not increased so much in number, they have increased considerably in size, indicating a return from the hand-to-mouth buying to a more stable basis. At the same time inquiries have become more numerous. Effective Aug. 22, the Link-Belt Company made a reduction of approximately 10 per cent on its general line of malleable iron and steel chains, sprockets, buckets, etc., and it is expected that this reduction in price will have a still further effect in increasing buying.

The New York territory seems to be the leader in the increased business, although the Far Western states are opening up in better shape. The Philadelphia, Middle West and Southern districts have shown little increase of late.

Larger Quarters for Motor Repair and Rental Company

The American Electric Service & Maintenance Company, 51-57 Taylor street, Springfield, Mass., announces that on Oct. 1 it will move to its new building on Liberty street, where it will occupy twice as much floor space as was formerly occupied and will increase its operating force. The increase in the business of electrical repairs of all kinds and in motor rentals necessitated this step.

Twenty-four Hundred Washers Sold in Six Weeks by St. Louis Concern

A spcial campaign recently conducted by the Domestic Electric Company of St. Louis, distributer of the Eden washer, gave the highly gratifying result of the sale to the public of about 2,400 washing machines in a period of six weeks. The territory covered includes eastern Missouri and southern Illinois. About 90 per cent of the sales were made in St. Louis.

The special feature of the campaign was a reduction in the list price from $160 to $109 for the period of the campaign only. Newspaper advertising was heavily employed, and in St. Louis a force of thirty worked directly in the homes. Two hundred and sixty-four machines were sold the first day. Based on the rate sales were made immediately prior to the campaign, only 400 machines would have been sold during this six weeks' period had it not been for the special means used, and consequently the campaign resulted in a net increase in sales of 2,000 machines. An interesting feature is that although normally sales for cash amount to about 10 per cent of the total, the cash sales during this period amounted to nearly 30 per cent.

The results obtained cause the Domestic Electric Company to believe that a field for good washing-machine business exists and that the public is ready to buy when the prices are lowered sufficiently to indicate a substantial reduction from the peak prices heretofore prevailing.

Salt Lake City White Way Uses Steel Shaft Standards

The Union Metal Manufacturing Company, Canton, Ohio, announces that the lighting standards to be used for the installation of street lighting in Salt Lake City's business district have cast-iron bases and pressed-steel shafts. The standards of the previous installation of ornamental lighting on Main Street were also made of these materials. It was announced on page 335 of the Aug. 13 issue of the ELECTRICAL WORLD that these standards were of ornamental casings of cast iron, and this occasion is taken to make this correction as noted by the manufacturer.

A. I. Mehan Starts New Company in Philadelphia

Andrew I. Mehan has inaugurated an electrical repair company and established a business as dealer in electrical power equipment at 309 Race Street, Philadelphia, under the firm name of Andrew I. Mehan Company. Mr. Mehan was formerly a partner in the Delta Equipment Company, Philadelphia.

Expansion in Foreign Commerce Bureau

New Foreign and Domestic Divisions Created and "Commerce Reports" Changed from Daily to Weekly

Beginning Monday, September 5, it is planned to change *Commerce Reports* from a daily to a weekly publication and to alter its physical arrangement from a rather unsystematized mass of important reports to a weekly trade paper scientifically prepared and classified on a commodity and geographical basis. The daily *Commerce Reports* was discontinued with the issue of Aug. 31. This plan has been under consideration for some time. Spot news will be handled through some other method.

In connection with this change the Bureau of Foreign and Domestic Commerce is rapidly organizing a number of special divisions, known as industrial or commodity divisions, which will specialize on important export commodities, among which are iron and steel, industrial machinery and electrical goods and machinery.

"The men being placed in charge of these divisions are recognized experts in their particular fields," says *Commerce Reports*. "They will keep in close personal touch with the centers of each industry through trade associations, trade papers and the manufacturers and dealers individually in an effort to ascertain the exact nature of the official assistance most urgently needed or which will be most generally useful. They will then proceed to obtain the required facts immediately through the department's existing world-wide facilities, making use of their expert knowledge in that industry or trade, to obtain information which will be readily understood in its true significance by American manufacturers.

"It is planned to have these commodity experts perform an important function in contributing specific trade information for the new weekly and for the various trade and news papers. They will also pass upon and interpret for the benefit of American business reports relating to such commodities as they are received from the trade representatives of this country now stationed at foreign posts. This elaborate attention to specific American industries was made possible by Congress in appropriating money and in transferring funds from other departmental activities for that purpose.

"From a geographical standpoint the bureau is now well fortified, with special divisions covering eastern Europe, western Europe, Latin America, the Far East and the Near East. The eastern and western European divisions were created within the past few days. They take the place of the former more general European division.

"From a technical standpoint, the bureau's facilities have recently been greatly strengthened by the creation of a division of commercial laws, which will pay special attention to the commercial codes of the important markets of the world, and this division will contribute to the new publication.

"The bureau is also giving special attention to transportation problems through the assistance of an expert on that subject recently appointed, dealing with freight problems both by land and by water."

Program for International Cost Conference Issued

The final program of the second international cost conference, to be held under the auspices of the National Association of Cost Accountants, at Cleveland on Sept. 14, 15 and 16, has been issued. Among the subjects to be discussed at the different sessions are the executive uses of a cost system, the distribution of overhead under abnormal conditions, cost of systems as a means of preventing waste and uniform methods and standardizing costs. Most of the railroads have granted reduced fares under the certificate plan for this conference, and it is expected that the largest and most representative gathering of cost men which has ever assembled in this country will meet in Cleveland. The national headquarters of the association are in the Bush Terminal Sales Building, 130 West Forty-second Street, New York City.

Lower Production and Sales Costs for Medart Pulley Company

The Medart Patent Pulley Company, Inc., St. Louis, in its August issue of the *Dart*, announces that since labor and materials have gradually taken a drop, the prices on its complete line of power-transmitting appliances have been reduced. The substantial reductions, effective Aug. 10, were further made possible through successfully establishing greater efficiency in production and consequently in the reduction of production costs.

Business conditions are steadily improving, says E. T. Cregier, sales manager of the company, and he expects good business during the balance of the year 1921.

Trumbull Company Declares Safety Switch Prices at Bottom

In a vigorous message to the trade in the August issue of *Trumbull Cheer* the Trumbull Electric Manufacturing Company, Plainville, Conn., calls attention to the fact that the latest price reduction (effective July 28) on safety switches represents a saving of from 20 to 40 per cent on prices effective four months ago, and points out that these prices are now at the 1916 level and are unlikely to decrease further. One of the causes leading to a stagnation in buying, says the company, has been the deep conviction of the buying public that prices must come down sharply. Distributers have kept their stocks at the scantiest minimum, ordering only from hand to mouth lest they get caught with high-priced material. Industrials have held off on making many needed improvements for the same reason.

After several years of wild scrambling to get orders out many a plant has become more or less in need of repair, and now that the price drop has come, the company states, purchases can be made on a pre-war basis. In 1916 externally operated entrance switches took a discount of 40 per cent in the trade. These are now 35 per cent. The company maintains that the present time is ripe for modernizing wiring installations and that switch costs to the consumer are as low as they are likely to be for years to come.

Fuse Manufacturer Goes on Full Time

The Ensign - Bickford Company, manufacturer of safety fuses at Simsbury, Conn., has inaugurated full-time factory production following a period of reduced weekly running. H. E. Ellsworth, vice-president, informed the ELECTRICAL WORLD last week that while there is no marked revival in orders as yet, the character of the orders received indicates that the stocks of the company's products held throughout the country are relatively small, and that the business received indicates actual consumption of finished material. Orders are still far from large but are better than in the early months of the year. A gradual improvement rather than a boom in business is anticipated, and the former seems likely to be accompanied by fluctuations in demand.

American Wiremold Company Issues Net Price Sheets

The American Wiremold Company, Hartford, Conn., has recently begun to issue net price sheets in place of the former list and discount notifications, and officials of the company say that a number of congratulatory letters have been received from the trade expressing appreciation of the revised method. In the company's Card No. 10 dated Aug. 22, 1921, thirty-nine items are shown, with prices quoted to contractor-dealers on standard-package, unit-package and less-than-unit quantities. Each of the items listed in the price schedule is illustrated on the border of the sheet, with corresponding number and title to make identification easy.

Electrical Sheet Maker Holds Sales Convention

Follansbee Brothers Company, Pittsburgh, called its salesmen and district office managers in to a conference the last week in August. The company manufactures electrical sheets for motors and generators at its Follansbee (W. Va.) plant and at the present time makes its automobile sheets and other steel at that plant.

The purpose of the meetings was to get the outside viewpoint on the steel market, with the ultimate aim of opening up the company's new sheet plant at Toronto, Ohio, if this should appear advisable. This would take some of the other sheet production to Toronto and leave more capacity for electrical sheets at Follansbee. The Follansbee plant has been working full time for the last four or five weeks and still has several full weeks' production on its books. Reduced automobile prices have kept up the demand for automobile sheets, but the automobile makers seem to be hesitant on the market because they are buying for only a short time ahead.

Steubenville, Ohio, was picked out as the convention place because of its accessibility both to the Follansbee plant and to the Toronto plant. About fifty-five of the sales and managerial staff were present, and the convention was considered a distinct success.

Hurley Machine Increases Officer Personnel

At a meeting of the board of directors of the Hurley Machine Company, 24 East Jackson Boulevard, Chicago, held on Aug. 22, the number of vice-presidents of the company was increased from three to five, Edward N. Hurley, Jr., and James A. McCoy being elected to fill the vacancies thus created. John Proudfoot, who had been assistant treasurer of the company, was elected treasurer to fill the vacancy created by the promotion of Mr. McCoy. Mr. McCoy also is secretary. The other three vice-presidents are Myer Hurley, Alva J. Fisher and Thomas J. Casey. Edward N. Hurley is chairman of the board and Neil C. Hurley is president.

Brazilian Bonds Issued for Purchases in United States

The United States of Brazil is offering a new issue of $25,000,000 twenty-year 8 per cent (non-callable) external gold bonds, dated June 1, 1921, in denominations of $500 and $1,000, exempt from all Brazilian taxes, present or future.

The proceeds of this loan are to be employed in part for the purchase in the United States of materials required by the government of Brazil, and as it is understood that government has extensive irrigation plans under way in northern Brazil, it is probable that irrigation and pumping equipment will be purchased in the United States.

The Delta-Star Electric Company, Chicago, has established a district office at 310 Security Building, Minneapolis, in charge of J. E. Sumpter.

The Tubular Woven Fabric Company, Pawutcket, R. I., has filed amendments to its charter increasing its capital stock from $350,000 to $600,000.

The Lincoln Electrical Company, Cincinnati, with an office in the Mercantile Building, has leased a four-story building at 32 East Front Street for warehouse purposes. The main offices of the company are in Chicago.

The Hopewell Insulation & Manufacturing Company, Hopewell, Va., has appointed Charles A. Etem, 917 Marquette Avenue, Minneapolis, and the Coast Equipment Company, 766 Folsom Street, San Francisco, as its representatives in these respective territories.

Foreign Trade Notes

EXTENSION OF ONTARIO HYDRO-ELECTRIC SYSTEM INTO RURAL DISTRICTS. — In order to bring electricity within the reach of a greater number of farmers in the Province of Ontario, Canada, the provincial government, according to the *Empire Mail*, is to grant a bonus of 50 per cent toward the extension of hydro-electric power transmission lines into new rural districts. Thousands of farmers throughout Ontario already have electric light and power, and one farm in every five has a telephone.

ELECTRICAL INDUSTRY IN AUSTRALIA.—More than 200 new industries, according to the *Electrician*, London, have been established in Australia since 1914, and under the influence of the high tariff and of the government encouragement new factories are rapidly increasing. A larger portion of the new works is occupied in the manufacture of iron and steel goods, agricultural machinery, gas, steam and oil engines, electrical machinery and apparatus. Among the electrical equipment now produced in Australia are batteries and parts, circuit breakers, conduit, tubing and fittings, motor controllers, motors, generators, fuses, porcelain insulators, mica for electrical purposes, radiators, resistors, starters, switches, etc.

PROPOSED HYDRO-ELECTRIC SCHEME IN GREENVILLE, AUSTRALIA. —An engineer has been engaged by the Greenville Shire Council to report on a hydro-electric power project near Scarsdale, Greenville, Australia.

PROPOSED ELECTRIC RAILWAY FOR PEKING.—Arrangements have been made by the municipal authorities of Peking with the Banque Industrielle de Chine for the construction of electric railways. The capital of the tramway company is to be $4,000,000 half of which is to be raised by public subscription. Work will not be started on the project until the funds are raised.

PROPOSED WATER-POWER DEVELOPMENT IN FINLAND.—The Finnish Ministers of the Interior, Industry and Transport, according to the *Electrician*, decided in May last to start on the work of developing the series of waterfalls known as the Imatra group of rapids. If fully developed, it is estimated that 150,000 hp. of electrical energy will be available. It has been decided to appropriate the land that will have to be flooded and to begin work about 1922. An expropriation of 20,000,000 Finnish marks was made in the budget for 1921 and this sum is being expended in connection with preliminary work. The total cost of the project, including land to be purchased, is estimated at 267,000,000 Finnish marks. The rapids of Ritikka, Mansikka, Ranankoski and Linnankoski, as well as the big Imatra Falls, are included in the scheme. The rapids are distributed over a distance of 4½ km., and have a fall of 24 m.

THAMES VALLEY PROJECT, NEW ZEALAND.—The Thames Valley Electric Power Board, according to *Electrical Industries*, has decided to ask the ratepayers to approve a further loan of £350,000 to complete the electrical scheme. The board, which has already borrowed £200,000, has completed 40 miles of transmission lines and has connected Paeroa with Waikino. A number of transmission lines have been extended in different directions from Paeroa.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A motion-picture industry company in Hungary (No. 35,371) desires to secure an agency for the sale of motion-picture electrical equipment, principally projectors, lamps, etc.

A mercantile firm in Spain (No. 35,385) having facilities for the marketing of merchandise all over Spain desires to be placed in touch with manufacturers of motors, electrical machinery, telephones, ventilators, counting machines, adding machines, all kinds of lighting fixtures, accessories and installations, turbines, generators, insulating materials, wire, cable, etc. It is the desire of this house to secure exclusive representation of these products.

A representative of a firm in Venezuela (No. 35,373) is in the United States for the purpose of purchasing and securing an agency for the sale of hydraulic equipment, scientific instruments, etc.

New Apparatus and Publications

ELECTRICALLY DRIVEN KITCHEN EQUIPMENT.—The Maxim Manufacturing Company, 700 West Twenty-second Street, Chicago, has recently perfected a dish-washing, vegetable-peeling and ice-cream-freezing machine in one combination, known as "Maxim Maid." A six-page pamphlet describing this device is being distributed.

TRANSFORMER TEMPERATURE INDICATOR.—Bulletin No. 46,041 issued by the General Electric Company, Schenectady, N. Y., describes the type H-2 A-C temperature indicator for transformer windings recently developed by the company.

PYROMETER.—The Brown Instrument Company, Philadelphia, has just made improvements in the automatic compensating features of its "Thermo-Electric" pyrometers.

CONTROL SWITCH. — The South Bend Current Controller Company, South Bend, Ind., announces its new R-C-O-C remote-control switch for station control of outdoor lighting and other loads.

FITTINGS.—The Erie Electrical Equipment Company, Inc., Johnstown, Pa., has issued discount sheets dated July 15 and two new catalog sheets on split porcelain insulators and pipe-frame fittings and caps.

ELECTRIC FURNACES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, has issued catalog 9-C, on electric furnaces.

SPOT WELDER. — A new bench-type spot welder, the S-4-B, has been placed on the market by the Taylor Welder Company, Warren, Ohio.

TRACTOR CRANE. — A full revolving tractor crane, types BC and BT, for operation independently of rails has been developed by the Industrial Works, Bay City, Mich.

HYDRAULIC TURBINES. — The Wellman-Seaver-Morgan Company, Cleveland, is distributing bulletins Nos. 64 and 65, entitled "Hydraulic Turbine Equipment for San Francisquito No. 2 Plant" and "Turbines for Niagara's High-Head Plant" respectively.

MOTORS. — The Mechanical Appliance Company, Milwaukee, has issued bulletins Nos. 401, 402, 403, 404 and 405, covering the "Watson" direct-current motors, alternating-current motors, multi-speed motors, slip-ring and high-torque motors and ball bearing motors respectively.

OIL CIRCUIT BREAKERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued special publication 1643, entitled "Application of Oil Circuit Breakers."

BATTERY EQUIPMENT.—S. R. Orum, 503-505 North Eleventh Street, Philadelphia, manufacturer of battery shop equipment, has issued a new catalog covering his products.

SAFETY SWITCHES AND PANELBOARDS. — Catalog 12-A issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., includes new types of safety motor starters and safety panelboards.

PANELS.—The Automatic Electrical Devices Company, 120 West Third Street, Cincinnati, is distributing bulletin 624, describing its new "Unipanel" refinements.

ELECTRIC WELDER.—The Automatic Electrical Devices Company, 120 West Third Street, Cincinnati, has issued bulletin 623, describing its automatic arc welder.

GENERATORS, MOTOR-GENERATORS AND DYNAMOTORS.—The Electric Specialty Company, Stamford, Conn., has issued bulletin 237, superseding bulletin 231, describing the "ESCO" high-voltage generators, motor-generators and dynamotors.

INSULATORS.—The Porcelain Insulator Corporation, Lima, N. Y., is distributing bulletins No. 1 and 2, covering its "Pinco" insulators.

WALL CASE. — The Hart & Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn., is distributing a four-page leaflet describing its new "H & H" sectional wall case.

CANOPY PULL SWITCH.—The Bryant Electric Company, Bridgeport, Conn., has recently brought out a new pull switch for use inside the canopy of ceiling or wall fixtures.

EVAPORATOR WALL SET.—A complete evaporator set for providing small quantities of distilled water has recently been developed by the Griscom-Russell Company, 90 West Street, New York City.

BATTERY IGNITION SYSTEM.—A new battery ignition system for Ford automobiles has recently been brought out by the American Bosch Magneto Corporation, Springfield, Mass. The company is distributing a small folder describing this type (FI-513) of Bosch battery ignition system.

New Companies

THE CLINTON ELECTRIC COMPANY, 266 Springfield Avenue, Newark, N. J., has been organized to manufacture parts for electric motors and operate a general motor and repair works. Edward Snyder is interested in the company.

E. L. WESTERVELT, INC., Lawrence, N. Y., has been chartered with a capital of $50,000 to manufacture electric motors, etc. The incorporators are E. L. Westervelt, L. H. Hall and W. Schneider.

THE DOMAN MANUFACTURING CORPORATION, Elbridge, N. Y., has been incorporated with a capital of $200,000 by A. E. Doman, Elbridge, and others. The company proposes to manufacture electrical and mechanical equipment.

THE ACME ELECTRIC COMPANY, Charleston, W. Va., has been incorporated with a capital of $25,000 to operate an electric light and power system in the vicinity of Charleston. John B. Ray and W. D. Payne, Charleston, are interested in the company.

THE SUNSHINE LAND & POWER COMPANY, Knoxville, Tenn., has been chartered with a capital of $20,000 to furnish electricity for light and power purposes in the vicinity of Knoxville. J. E. Dupes and M. L. Wolf are interested in the company.

THE SANDERSON (TEX.) ICE, WATER & LIGHT COMPANY has been chartered by John Kerr and W. H. Mansfield to operate an electric light and power system in Sanderson. The company is capitalized at $50,000.

ALEXANDER MORRISON & COMPANY, INC., Newark, N. J., has been incorporated by Morris A. Potter, L. M. Scheer and E. T. Adams, 11 Gotthart Street. The company is capitalized at $100,000 and proposes to manufacture boilers and other power equipment.

THE C. & D. LIGHTING & FIXTURE COMPANY, Paterson, N. J., has been incorporated with a capital of $10,000 to manufacture electrical equipment. The incorporators are Peter M. DeRuyter, M. L. and R. Harold Clement, 90 Washington Street.

THE HOWLAND LAMPS MANUFACTURING COMPANY, Malden, Mass., has been incorporated with a capital stock of $50,000 to manufacture incandescent lamps. The incorporators are Fred C. Howland and Thomas Murphy, Malden, and Charles M. Waugh, Cambridge.

THE RIALTO ELECTRICAL COMPANY, New York, N. Y., has been incorporated by E. and R. Goldberg and C. Diringer, 185 Madison Avenue. The company is capitalized at $10,000 and proposes to manufacture electrical specialties.

THE ALFRED COVERED WIRE COMPANY, Brooklyn, N. Y., has been chartered with a capital stock of $15,000 to manufacture electrical wires. The incorporators are A. Gleckel, J. H. Johansen and J. C. Von Glahn, 115 Broadway.

THE GUERIN THEATER SEATING SYSTEM, Iberville Street, New Orleans, La., has been incorporated with a capital of $500,000 to manufacture an electrical indicator board for theater seating. Morinville Guerin is president of the company.

THE NAGEL BATTERY & ELECTRICAL COMPANY, Springfield, Mass., has been incorporated by Clarence L. Nagel and E. S. Hahn, Cambridge. The company is capitalized at $35,000 and proposes to manufacture electrical equipment.

Record of Electrical Patents

Notes on United States Patents

(Issued Aug. 9, 1921)

1,386,607. ELECTRIC WATER HEATER; Adrien F. de Raignau, Montreal, Canada. App. filed Oct. 4, 1920. Heating elements will cover a relatively large area.

1,386,616. CIGAR AND CIGARETTE LIGHTER; Felix Grandich, New York, N. Y. App. filed Nov. 18, 1919. Pressure of the cigar or cigarette upon a resistance coil will complete circuit.

1,386,650. SEPARATOR FOR STORAGE BATTERIES; Paul E. Norris, Pittsburgh, Pa. App. filed March 10, 1920. Separator for batteries of the lead and acid type.

1,386,689. TELEPHONE SYSTEM; Roy D. Conway, Chatham, N. J. App. filed June 6, 1918. Provision of improved signaling means.

1,386,705. ELECTRICALLY HEATED CONTAINER; James T. Griffin, Oak Park, Pa. App. filed Sept. 24, 1920. Heating element is made readily accessible for repair or replacement.

1,386,830. METHOD OF AND APPARATUS FOR PRODUCING AND DISTRIBUTING ELECTRIC CURRENT WAVES OF RADIO FREQUENCY; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 5, 1915. To provide apparatus for producing an electric current wave which is the equivalent of two electric current waves of different frequencies and of substantially constant amplitudes.

1,386,840. RADIO SIGNALING SYSTEM; Reginald C. Clinker, Rugby, England. App. filed Nov. 29, 1919. To render receiving apparatus more readily portable and more compact.

1,386,844. AUTOMATIC OPERATING MEANS FOR INTERNAL-COMBUSTION ENGINES; Henry K. Cowen, Milwaukee, Wis. App. filed March 1, 1920. Means for automatically starting and stopping.

1,386,861. CONSTANT-SPEED MOTOR; Chester L. Hall, Fort Wayne, Ind. App. filed Jan. 28, 1920. To make the speed of the motor substantially constant irrespective of variations both of voltage and frequency.

1,386,877. CONDUIT-BODY ANGLE ADAPTER; Homer G. Knoderer, Englewood, N. J. App. filed Oct. 18, 1920. Mounted upon the outlet box and provided with means for securing thereto the covers which are ordinarily secured directly to the outlet boxes.

1,386,884. ELECTRICAL FITTINGS CONNECTION; John A. McKaw, New York, N. Y. App. filed Oct. 25, 1919. Relates to electrical fixtures connections.

1,386,885. MOTOR CONTROL FOR HOISTS; Robert H. McLain, Schenectady, N. Y. App. filed May 7, 1919. Provides improved means whereby motors may be started and stopped and generally controlled.

1,386,895. STORAGE BATTERY; Charles Olsson, Milwaukee, Wis. App. filed April 3, 1919. To increase durability by protecting separator plates at points where the deterioration is most rapid.

1,386,898. PROTECTION OF SYSTEMS OF DISTRIBUTION; David B. Rushmore, Schenectady, N. Y. App. filed March 21, 1918. Protection from damage by reason of abnormal events occurring in the system.

1,386,912. CONTAINER FOR INSULATING OR IMPREGNATING COMPOUNDS; William A. Timm, Berwyn, Ill. App. filed July 8, 1918. Relates to portable supply tank for replenishing supply of insulating or impregnating compound.

1,386,946 TERMINAL STRUCTURE FOR ELECTRIC BATTERIES; Paul E. Norris, Pittsburgh, Pa. App. filed Feb. 18, 1920. Effective to prevent leakage of the liquid contained in the battery.

1,386,972. AUTOMATIC CONTROL OF ELECTRIC GENERATING SETS; Leo Sunderland and Gilbert C. Pillinger, Westminster, London, England. App. filed Feb. 18, 1918. Emergency or stand-by for lighting purposes.

1,387,016. WRAPPING MACHINE; John Scherner and Edward Hutchens, Milwaukee, Wis. App. filed April 3, 1916. Wrappings for automobile tires.

1,387,023. METHOD OF AND APPARATUS FOR TREATING METAL; Herbert D. Swift, New York, N. Y. App. filed March 27, 1920. Relates to the annealing of metals.

1,387,047. POLYPHASE MOTOR; Valere A. Fynn, St. Louis, Mo. App. filed Feb. 14, 1917. To enable motors to be started and brought up to speed with a small current while keeping full control of power factor.

1,387,048. SPEED-REGULATING APPARATUS; Valère A. Fynn, St. Louis, Mo. App. filed July 5, 1919. Electromagnetic means for regulating speed of prime movers.

1,387,076. MOTOR VEHICLE; Jabea F. Shawhan, Dayton, Ohio. App. filed Jan. 19, 1917. Electric driving motor supplied with power from an electric machine driven by a prime mover.

1,387,149. VOLTAGE-REGULATING APPARATUS; Valere A. Fynn, St. Louis, Mo. App. filed June 26, 1918. Applicable where the speed of prime mover is likely to vary over wide range.

1,387,162. X-RAY TUBE-CONTROLLING MECHANISM; Harry A. Mulvany and Harry E. Kennedy, Berkeley, Cal. App. filed Jan 24, 1918. Controlling the current flow through X-ray tubes.

1,387,171. TELEPHONE-EXCHANGE SYSTEM; Lipa Polinkowsky, New York, N. Y. App. filed Feb. 20, 1919. Connections extended in part by automatic switching apparatus and in part by use of operators' link circuits.

1,387,174. MACHINE-SWITCHING TELEPHONE SYSTEM; Winifred T. Powell, East Orange, N. J. App. filed Aug. 16, 1918. Related particularly to overflow trunking arrangements.

1,387,180. TELEPHONE SYSTEM; John N. Reynolds, Greenwich, Conn. App. filed Nov. 21, 1917. Relates to form of automatic switching apparatus.

1,387,181. TELEPHONE EXCHANGE SYSTEM; William A. Rhodes, New York, N. Y. App. filed Sept. 30, 1918. Provides improved means for establishing communication between desk operator and switchboard operator.

1,387,189. COMBINED TOOL POUCH AND TESTING DEVICE; Albert E. Sharkey, Cuyahoga Falls, Ohio. App. filed March 6, 1920. Adapted for electrician in repair and testing of lines and apparatus.

1,387,210. METHOD AND MEANS FOR CORRECTING IRREGULARITIES IN TRANSMISSION LINES; Morton Sultzer, Brooklyn, N. Y. App. filed Dec. 18, 1916. Multiple condenser may be adjusted.

1,387,228. SELECTIVE SYSTEM; John H. Bell, East Orange, N. J. App. filed July 26, 1917. For use in printing telegraphs and the like.

1,387,229. TELEGRAPH SYSTEM; John H. Bell, South Orange, N. J. App. filed April 9, 1918. Object to provide an effective and reliable remedy for the so-called "wandering zero."

1,387,250. TELEPHONE-EXCHANGE SYSTEM; Clarence B. Fowler, New York, N. Y. App. filed Sept. 23, 1919. Relates to a line circuit for use in such systems.

1,387,251. TELEPHONE SYSTEM; Clarence B. Fowler, New York, N. Y. App. filed Dec. 16, 1919. Production of improved signaling means.

1,387,252. TEST CONNECTORS; John Fredricks, Kingsbridge, N. Y. App. filed Feb. 14, 1918. Adapted to occupy little more space than apparatus terminal itself.

1,387,255. TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed Dec. 31, 1919. Relates to circuit arrangements for selector switches.

1,387,262. RECEIVING APPARATUS FOR WAVE-SIGNALING; Ralph V. L. Hartly, East Orange, N. J. App. filed Sept. 30, 1915. Adapted to receive telephonic or telegraphic messages.

1,387,270. SIGNALING AND TELEPHONE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed March 27, 1918. Object of the invention is to provide improved means for developing pulsating signaling current.

1,387,271. TELEPHONE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed March 26, 1918. Relates to trunking arrangements used between an intercommunicating system and an exchange.

1,387,276. ELECTRIC VAPORIZING GASKET; Wilber Kutsche, Western, Neb. App. filed April 7, 1921. Relates to improvements in fuel vaporizers.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

DAMARISCOTTA, ME. — The power plant of the Lincoln Power Company and the leather-board mill of the Damariscotta Leather Company were recently destroyed by fire, causing a loss of about $100,000.

CHARLESTON, MASS. — The Charleston Gas & Electric Company contemplates rebuilding its coaling tower at Arlington Avenue and Hamblen Street, recently destroyed by fire. The loss is estimated at $15,000.

GREAT BARRINGTON, MASS. — The Southern Berkshire Power & Light Company has awarded contract to the F. T. Ley Company, Springfield, for the construction of power house, dam and penstock on the site of the old Rockdale Mills in Williamsville. Contract has also been awarded by the company for building the new dam at its plant on Upper Main Street in Great Barrington.

WORCESTER, MASS.—Plans have been completed for the proposed automobile manufacturing plant of the R. H. Long Company to be erected on Millbrook Street, to cost about $200,000. A one-story power house to cost about $22,000 is included in the project.

FORESTDALE, R. I.—Plans have been completed by the Forestdale Manufacturing Company for the construction of a new power plant at its cotton mills.

NEW BRITAIN, CONN.—Extensive additions and improvements are being made by the Connecticut Light & Power Company to its local system. The cost of the work is estimated at $250,000 and will include a distributing station and substation now being installed at Corbin Place. The Black Rock substation is being rebuilt to enable it to handle the current when the present supply from Bunker Hill, Waterbury, is stepped up from 33,000 volts to 66,000 volts.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by Edward Riegelmann, president of the Borough of Brooklyn, Room 21, Borough Hall, Brooklyn, until Sept. 7 for general construction, including electric work, of a public bath at the corner of Metropolitan and Bedford Avenues, Brooklyn.

FAR ROCKAWAY, N. Y.—The Public Service Commission has granted the Queens Borough Gas & Electric Company permission to issue $2,229,000 in capital stock, part of the proceeds to be used for extensions and improvements.

LOCKPORT, N. Y.—The Wickwire Limestone Company, River Road, Buffalo, contemplates rebuilding the power plant at its local properties, recently destroyed by fire. The loss is estimate at about $30,000.

NEW YORK, N. Y.—Bids will be received by Thomas J. Drennan, Fire Commissioner, Eleventh Floor, Municipal Building, New York City, until Sept. 6 for construction of a portion of the underground fire alarm system in the Borough of Brooklyn. Blank forms and further information may be obtained at the above office.

NIAGARA FALLS, N. Y.—The Niagara Falls Power Company contemplates the erection of a new electric transmission line from Niagara Falls to Buffalo, through Grand Island. Work on the proposed line, it is said, will begin as soon as the Public Service Commission gives its approval of the project.

POUGHKEEPSIE, N. Y. — The Central Hudson Gas & Electric Company has applied to the Public Service Commission for permission to build an addition to the electric plant in the town of East Fishkill.

UTICA, N. Y.—The board of directors of the Utica State Hospital, Utica, it is said, will soon call for bids for a new cold storage plant, 70 ft. x 100 ft., to cost about $65,000.

ATLANTIC CITY, N. J.—The Board of Publicity Commissioners has granted the Atlantic Electric Company permission to issue $144,100 in capital stock, the proceeds to be used for proposed extensions and improvements.

EAST ORANGE, N. J.—Bids will be received by the Board of Fire Commissioners, East Orange, N. J., until Sept. 6, for construction of 5 miles of underground conduits.

GLASSBORO, N. J.—The Borough Council has entered into a contract with the Electric Company of New Jersey, Salem, for lighting the principal thoroughfares of the borough with electricity, to replace the gas lamps now in use.

JERSEY CITY, N. J.—The plant of the Vulcan Iron Works, at Hudson and Essex Streets, Jersey City, including power house, machine and pattern shops, was badly damaged by fire recently, causing a loss of about $250,000.

POMPTON LAKES, N. J.—The Borough Council has authorized the Water and Light Department to arrange for additional water supply to double the capacity of the municipal electric light plant.

ALLENTOWN, PA.—Plans have been approved by the City Council for extending the street-lighting system on Hamilton Street from Penn to Second Street, and on Seventh Street from Hamilton to Walnut Street.

HARRISBURG, PA. — Steps have been taken by the North Second Street Business Association to secure better street lighting and street-car service in that district of the city.

PHILADELPHIA, PA.—Plans have been filed by the James Doak, Jr., Company, 2185 East Norris Street, for the erection of a one-story power house at its manufacturing plant.

PHILADELPHIA, PA. — Contract has been awarded by the Philadelphia Rapid Transit Company, 1520 Spruce Street, for the construction of a one-story car repair works at Thirty-first and Dauphin Streets, to Henry E. Baton, 1713 Sansom Street. The cost is estimated at about $50,000.

PLEASANT GROVE, PA.—The York Haven Water & Power Company, York Haven, is planning to erect a new transmission line to Pleasant Grove.

READING, PA.—The Philadelphia & Reading Coal & Iron Company contemplates extensions to its high-tension transmission system in the territory adjacent to Shenandoah.

READING, PA.—The installation of an electric lighting plant at the Maidencreek pumping station is under consideration by the City Council.

BALTIMORE, MD. — Plans are under consideration by William F. Broening, Mayor, for the installation of electrical conduits in Guilford Avenue from Thirty-third Street to University Parkway and in Twenty-fifth Street from Greenmount Avenue to Hartford Road.

CUMBERLAND, MD.—Work, it is understood, will begin at once on the first unit of the new plant of the Paragon Motor Car Company, to be located on Mount Savage Road. The plans call for a structure 165 ft. x 480 ft., with several smaller buildings and a power plant.

OXFORD, MD.—The Board of City Commissioners has made application for authority to establish an electric power plant for municipal service. Bonds for the proposed plant will be issued in the near future.

SYKESVILLE, MD.—The Freedom District Electric Light Company, recently incorporated, contemplates building an electric light and power plant. John T. Scott, Sykesville, is one of the incorporators.

WASHINGTON, D. C.—The Potomac Electric Power Company has been authorized by the Public Utilities Commission to issue $2,235,115 in bonds, the proceeds to be used for reimbursing the company for expenditures already made and for extensions and improvements to be made during the remainder of this year.

WASHINGTON, D. C.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a power house at Lake Denmark, N. J.

North Central States

ALMA, MICH. — The City Commission has voted to extend the ornamental lighting system on East Superior Street from Gratiot Avenue to the Race Bridge. Extension of the ornamental lighting system on State Street is being agitated.

INDIANAPOLIS, IND.—Extensions and improvements to the power house at the County Jail are under consideration by the County Commissioners.

INDIANAPOLIS, IND.—Plans are under way by the Active Coal Company, 607 Board of Trade Building, for the construction of a coal-handling plant at Fourteenth and Senate Streets, to cost about $50,000. Bacon & Teislow, 30 West Ohio Street, are engineers. P. M. Gale is president.

KENDALLVILLE, IND.—Arrangements have been made by the City Council for a one-story addition, 50 ft. x 100 ft., to the municipal electric light plant.

PERU, IND.—Extensions and improvements to the power house at the high school, to cost about $80,000, are under consideration by the Board of Education. Ammerman & McCall, Occidental Building, Indianapolis, are engineers.

PORT WING, WIS.—The Northern Wisconsin Hydro-Electric Power Company, recently organized, is planning to develop a water power site at Orienta Falls on the Iron River, where it is estimated that 3,385 hp. can be developed. Work on the project, it is understood, will be undertaken early next spring. The cost is estimated at $375,000.

BEATRICE, NEB.—The City Commissioners have instructed W. H. Anderson, city electrician, to prepare an estimate of cost of installing an electric plant of sufficient capacity to supply electricity for domestic and commercial purposes for the city.

DUNN CENTER, N. D.—The local electric light plant and elevator was recently damaged by fire, causing a loss of about $30,000.

HADDAM, KAN.—Plans are being prepared by W. B. Rollins, engineer, 209 Railway Exchange Building, Kansas City, Mo., for the erection of a transmission line and distribution system in Haddam, to cost about $22,000. E. L. Bowman is city clerk.

Southern States

LENOIR, N. C.—Preliminary plans, it is reported, are under way by the Caldwell Power Company, recently incorporated with a capital stock of $300,000, for the construction of a hydro-electric power plant. J. H. Beall and J. L. Nelson are among the incorporators.

COLUMBIA, S. C.—The Columbia River & Navigation Company has been authorized by the Federal Power Commission to construct a canal 25 miles long and 200 ft. wide, to connect the Santee and Cooper Rivers, also to erect an electric line from Columbia to Greenwood and to construct a dam to develop 30,000 hp. The cost of the project is estimated at $5,000,000. G. A. Guignard is president.

ATLANTA, GA.—The Lullwater Company, Atlanta, recently organized with a capital stock of $2,000,000 has acquired a six-story building, containing about 110,000 sq.ft., which it will equip for the manufacture of automobile equipment and accessories. A portion of the works will be used for battery repair operations. Lionel J. Kahn is manager.

APALACHICOLA, FLA.—The Apalachicola Land & Development Company is considering the installation of an electric power plant at its properties. J. J. Abbott is manager.

DAYTONA BEACH, FLA. — Plans are under way by the Peninsula Ice & Cold Storage Company, recently organized, for the construction of an ice-manufacturing plant with an initial output of 30 tons daily. The company also plans to erect a cold-storage plant. Guy G. Bailey is president.

KEY WEST, FLA.—Extensive improvements are contemplated by the Key West Electric Company, including the construction of a building, installation of a 750-hp. cross-head type crude oil engine and a 500-kva. generator. The cost is estimated at about $135,000. Bascom L. Grooms is manager.

PENSACOLA, FLA.—A preliminary permit has been granted by the Federal Power Commission to Fred Bingham for power project No. 55. The present plans provide for the construction of five dams and power houses with equipment to develop hydro-electric power on Perdido River, about 8 miles south of Muscogee, a dam 13.5 ft. high, a dam 13 ft. high 1 mile north of Muscogee, a dam 17 ft. high above Barrineau, and a dam 25 ft. high on Styx River about 8 miles north of Spanish Trail. The work will be under the supervision of the United States Geological Survey.

CHATTANOOGA, TENN.—Plans are under way by the Chattanooga Warehouse & Cold Storage Company, 212 King Street, for a two-story and four-story addition to its cold-storage plant. Bouchard & Company, Nashville, Tenn., are engineers.

CROWLEY, LA.—Improvements are contemplated to the municipal electric light plant, including the installation of two engines.

KINGSTON, OKLA.—The local electric light and ice plant and municipal waterworks station was recently damaged by fire, causing a loss of about $25,000.

PAWHUSKA, OKLA.—At an election to be held Sept. 6 the proposal to issue $113,000 in bonds for extensions and improvements to the municipal electric light plant will be submitted to the voters.

TAHOKA, TEX.—Electric light bonds to the amount of $14,000 have been voted.

TEXLINE, TEX.—Bonds to the amount of $55,000 have been voted for the construction of a municipal electric light plant and water system in Texline. J. H. Bender, Clayton, N. M., is engineer in charge of the work.

Pacific and Mountain States

SEATTLE, WASH.—An ordinance authorizing the installation of ornamental lamps in the McKinley Park district has been introduced in the City Council.

SPOKANE, WASH.—Plans have been filed for a two-story addition to the power plant of the Sacred Heart Hospital, to cost about $10,000.

FRESNO, CAL.—Plans are being prepared by the San Joaquin Light & Power Corporation for the erection of a one-story building, 130 ft. x 150 ft., to cost about $25,000.

OAKDALE, CAL.—Application has been filed with the Federal Power Commission by the officials of the Oakdale and South San Joaquin Irrigation District for permission to develop power in connection with an irrigation project at the Melones dam. It is proposed to supply electricity for irrigation and domestic purposes in both districts. The cost of the work is estimated at $1,500,000.

SAN FRANCISCO, CAL.—The Mount Shasta Power Corporation has petitioned the Federal Power Commission for a preliminary permit for two projects, known as Developments Nos. 3 and 4, each to consist of a dam, tunnel and power station, located on Pit River.

LEONIA, IDAHO.—The Idaho Gold & Ruby Mining Company is reported to be considering the installation of a 2400-hp. electric plant to supply electricity for lamps and motors at its property in Leonia.

PHOENIX, ARIZ.—The Arizona Power Company contemplates extensions and improvements to its system, involving an expenditure of about $120,000.

Canada

GLACE BAY, N. S.—A report is being prepared by N. H. Brown of New Glasgow on the centralization of the electric light and power plants.

CHATHAM, ONT.—The Hydro-Electric Power Commission will start work at once on the erection of a transmission line from Chatham to Kent Center. Two other lines in Kent County, one to Louisville and the other into Raleigh, are under consideration by the commission.

TIMMINS, ONT.—The Hollinger Consolidated Mines, Ltd., is planning a hydro-electric development, to cost about $2,000,000. Sutcliffe & Neelands, New Liskeard, are engineers.

TORONTO, ONT.—The Hydro-Electric Power Commission will soon apply to the provincial government for approval of plans for primary line extensions covering 175 miles, to cost about $375,000. The Hydro-Electric Commission is to proceed with work in the townships of Nepean, Edwardsburg, Nottawasaga, Howich, Saltfleet, Niagara, Howard, Ancaster, Dorchester, Beverly, Sandwich and West Flamboro.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City. Annual convention, Atlantic City, N. J., Oct. 3-7.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa. Annual meeting, Lake Placid, N. Y., Sept. 29-Oct. 1.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 W. 39th St., New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, S. E. Dillon, Hot Springs, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, Chicago, Ill., Sept. 19-24.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, M. B. W. Baker, Denver, Col. Annual convention, Glenwood Springs, Col., Sept. 19, 20 and 21.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-treasurer, E. Donald Tolles, 52 Broadway, New York City.

ELECTRIC FURNACE ASSOCIATION. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL MANUFACTURERS' COUNCIL. Executive secretary, Frederic Nicholas, 522 5th Ave., New York City.

ELECTRICAL SAFETY COUNCIL. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

Directory of Electrical Associations

Printed in the First Issue of Each Month

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City. Annual convention, Lake Placid, N. Y., Oct. 6-7.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

GREAT LAKES DIVISION, N. E. L. A. Secretary, R. V. Prather, 305 De Witt Smith Bldg., Springfield, Ill. Annual convention, French Lick Springs, Ind., Sept. 21-23.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Rochester, N. Y., Sept. 26-29.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual convention, Colorado Springs, Col., Sept. 6-10.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), Arthur J. Binz, Houston, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich.

MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, E. S. Myers. Vicksburg, Miss.

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NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ASSOCIATION OF RAILWAY AND UTILITY COMMISSIONERS. Secretary, James B. Walker, Public Service Commission of the State of New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, H. M. Davis, Brandeis Theatre Bldg., Omaha, Neb. Annual convention, Omaha, Neb., Sept. 14 and 15.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, New London, Conn., Sept. 6-9.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

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PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, A. Bliss McCrum, Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

ROCKY MOUNTAIN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, A. C. Cornell, Denver, Col. Annual convention, Glenwood Springs, Col., Sept. 19, 20 and 21.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. Assistant to the president, W. L. Goodwin, Guaranty Building, 522 5th Ave., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga. Annual convention, Chattanooga, Tenn., Oct. 17, 18 and 19.

SOUTHWESTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

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SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

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